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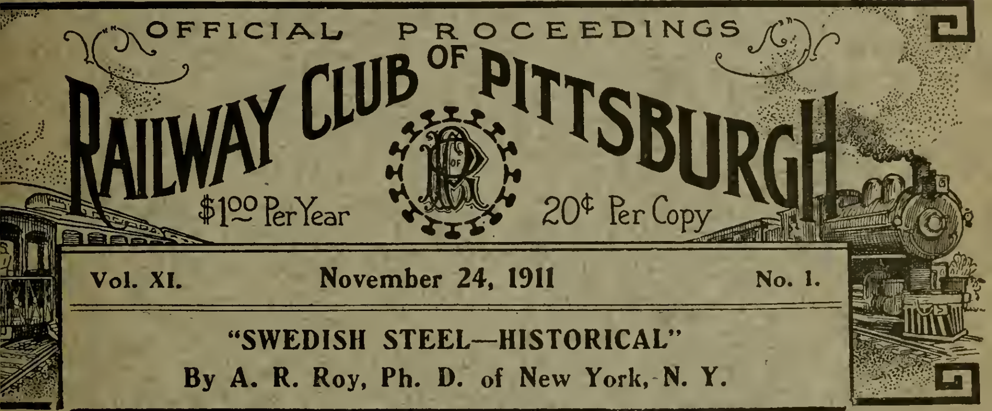

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Vol. XI. November 24, 1911 No. 1.

"SWEDISH STEEL—HISTORICAL"

By A. R. Roy, Ph. D. of New York, N. Y.

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¶ The Fifth Annual Convention MASTER BOILER MAKERS' ASSOCIATION was held at the Rome Hotel, Omaha, Nebr., May 23, 24, 25, 26, 1911.

¶ The Committee previously appointed reported on the subject of **"Steel vs. Iron Flue. What Advantage and What Success in Welding Them and the Effect of Tube and Maintenance."**

¶ Considerable interesting discussion ensued.

¶ For instance: The Foreman Boiler Maker of a large railroad in the middle East spoke as follows: (THE BOILER MAKER, June, 1911, page 167.)

> (Mr. ——) "We have been using steel flues for seventeen years, and I think we are pioneers in the business. About six years ago we tried a couple of sets of iron tubes; they lasted ninety days. We are getting about eight months out of the others. The —— Railway in the same locality has the same experience. Pitting is local. We don't have any either on iron or steel, but we have a heavy encrustation of lime; after one trip the tube is covered all over as if whitewashed. We have had seventeen years' experience with iron and steel tubes, and we are not going to change to the iron tube."

¶ We would suggest a second reading of the above. Seventeen years' experience would seem to be a sufficient length of time on which to base a logical conclusion.

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*This is the first of a series of announcements containing an opinion of an actual user of the Steel Boiler Tube.

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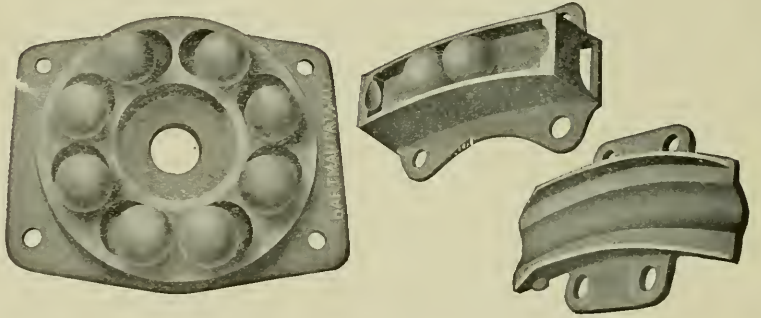

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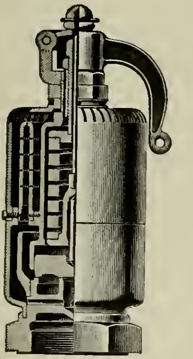

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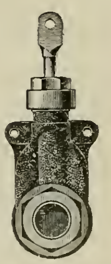

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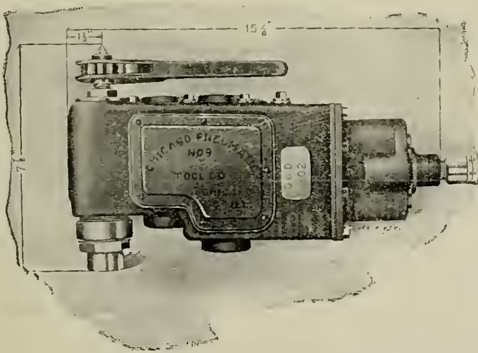

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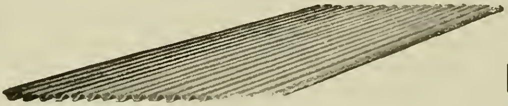

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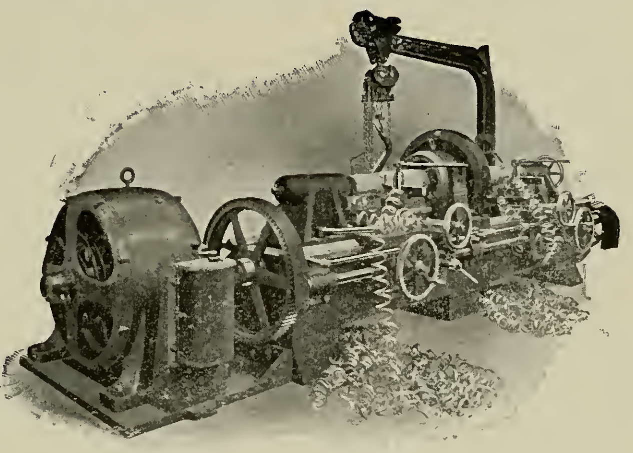

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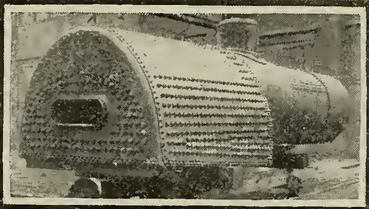

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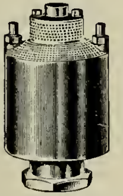

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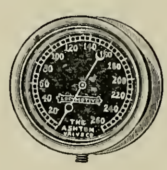

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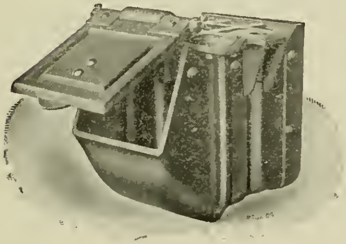

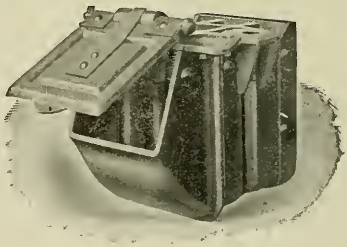

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VOL. XI. No. 1 **Pittsburgh, Pa., November 24, 1911.** $1.00 Per Year 20c Per Copy

Published monthly, except June, July and August, by the Railway Club of Pittsburgh, J. B. Anderson, Secretary, General Offices Penna. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING, NOVEMBER 24th, 1911.

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., with President F. R. McFeatters in the chair.

The following gentlemen registered:

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Lanning, C. S.
Lanning, J. Frank
Lehr, H. W.
Lobez, P. L.
Low, J. R.
Mackert, A. A.
Malloy, M. A.
Mensch, E. M.
Miller, F. H.
Mitchell, A. G.
Mooney, J. A.
McDaniel, C. W.
McDonnell, F. V.
McFeatters, F. R.
McNaight, A. H.
McNulty, F. M.
McVicar, G. E.
Peckstein, A. J. G.
Pfeil, John
Porter, H. V.
Proven, John
Rabold, W. E.
Redding, D. J.
Richardson, C. A.
Richardson, S. W.
Rinehart, H. W.
Rupp, R. D.
Ryan, M. F.
Schauer, A. J.
Schillar, John
Schomberg, W. T.
Smith, E. B.
Smith, M. A.
Snyder, Jos.
Stem, L. H.
Thomas, E.
Thurlby, A. R.
Toomey, J. J.
Unger, J. S.
Voigt, A. J.
Walther, G. C.
White, F. L.
White, J. D.
Wood, Ralph C.

VISITORS.

Allan, M. W.
Bridges, S.G.
Brophy, Ed. J.
Clark, A. F.
Croft, E. P.
Dole, Arthur L.
Edson, W. R.
Emmett, W. A.
Evans, D. S.
Fenton, E. A.
Fitzgerald, D. W.
Higgins, H. L.
Howe, Harry
Hurley, Theo.
Kinch, L. E.
Krepps, W. K.
Ralston, A. L.
Ranck, J. M., Sr.
Rodgers, S. M.
Roy, A. R.
Schaub, T. J.
Shapleigh, S. C.
Smoot, W. D.
Stearns, W. A.
Toby, George P.
Walter, W. A.
Waring, Wm.
Wickerhawn, F. A.

The minutes of the last meeting being in the hands of the printer, the reading of the same was dispensed with.

The Secretary read the following list of applications for membership:

Beatty, Harry M., Freight Conductor, Monon. Div., P. R. R., Elrama, Pa. Proposed by R. J. Doyle.

Bernard, R. Y., Railway Supplies, 426 Land Title Bldg., Philadelphia, Pa. Proposed by J. B. Anderson.

Brantlinger, J. H., Engineman, P. R. R., No. 226 Miller St., Mt. Oliver, Pittsburgh, Pa. Proposed by M. A. Malloy.

Croft, Elliot P., Engineman, Penna. Co., No. 1201 Winter St., Pittsburgh, N. S., Pa. Proposed by A. H. McNaight.

Crouch, John, Enginehouse Foreman, P. R. R., No. 418 Caldwell Ave., Wilmerding, Pa. Proposed by W. H. Sullivan.

Fitzgerald, D. W., Assistant Foreman Machine Shop, Penna. Co., No. 1600 Commerce St., Wellsville, O. Proposed by F. V. McDonnell.

Gray, T. H., Master Carpenter, P. R. R., Room 504, No. 1003 Penn Ave., Pittsburgh, Pa. Proposed by E. M. Craig.

Hawthorne, H. J., Car Accountant, Union R. R., Port Perry, Pa. Proposed by A. F. Coulter.

Herrold, A. E., Chief Clerk to Supt., M. P. & R. S., Monon. Conn. R. R., No. 1 Alger St., Pittsburgh, Pa. Proposed by F. M. McNulty.

Holbrook, W. H., Road Foreman of Engines, P. C. C. & St. L. Ry., 3273 Ashlyn St., Pittsburgh, Pa. Proposed by F. M. McNulty.

Howe, Harry, Inspector of Castings, Pressed Steel Car Co., McKees Rocks, Pa. Proposed by G. C. Baldwin.

Huber, F. A., Chief Clerk, Car Service Dept., B. & L. E. R. R., Greenville, Pa. Proposed by C. O. Dambach.

Kinch, Lewis E., Supervisor of Signals, P. R. R., No. 5919 Harvard St., Pittsburgh, Pa. Proposed by A. G. Mitchell.

Leslie, S. Inglis, Secretary and Treasurer, The Leslie Co., Lyndhurst, N. J. Proposed by J. B. Anderson.

Murphy, C. A., Train Dispatcher, P. R. R., Brownsville, Pa. Proposed by W. E. Macfarlane.

McFadden, John M., Clerk, P. & L. E. R. R., 102 P. & L. E. Terminal Bldg., Pittsburgh, Pa. Proposed by F. S. Weizel.

McWilliams, J. B., M. P. Inspector, P. R. R., Manor, Pa. Proposed by H. W. Rinehart.

Nops, A. M., Assistant Road Forman of Engines, B. & O. R. R., West Newton, Pa. Proposed by C. A. Richardson.

Pearson, A. B., Draughtsman, H. K. Porter Co. Locomotive Works, Forty-ninth St., Pittsburgh, Pa. Proposed by Karl Berg.

Pfister, A. J., Interchange Clerk, P. R. R., 1032 Lang Ave., Pittsburgh, Pa. Proposed by H. E. Boyle.

Pitcairn, N. B., Supervisor, P. R. R., Verona, Pa. Proposed by E. M. Craig.

Postlethwaite, C. I., Yard Master, P. R. R., West Brownsville, Pa. Proposed by W. E. Macfarlane.

Ranck, Jas. M., Assistant Inspector, Pressed Steel Car Co., McKees Rocks, Pa. Proposed by G. C. Baldwin.

Ream, A. H., Foreman, Machine Shop, P. R. R., Verona, Pa. Proposed by E. M. Craig.

Reeves, P. H., Master Mechanic, B. & O. R. R., Chillicothe, O. Proposed by A. W. Crouch.

Rhodes, Robert W., Foreman, P. R. R., Conemaugh, Pa. Proposed by H. W. Rinehart.

Rowe, Martin L., Mechanical Engineer, Carnegie Steel Co., Oakmont, Pa. Proposed by F. L. White.

Shade, C. E., Assistant Train Master, P. R. R., Verona, Pa. Proposed by E. M. Craig.

Smith, Chas. E., Draughtsman, P. R. R., 7236 Race St., Pittsburgh, Pa. Proposed by H. W. Rinehart.

Smith, F. W., Jr., Division Engineer, P. R. R., 1003 Penn Ave., Pittsburgh, Pa. Proposed by T. M. Blakley.

Smith, W. R., Division Operator, P. R. R., 103 Eastern Ave., Aspinwall, Pa. Proposed by Chas. J. Isler.

Spangler, C. P., Patternmaker, Monon. Conn. R. R., 4166 Second Ave., Pittsburgh, Pa. Proposed by F. M. McNulty.

Steele, William, Supervisor Electric Car Lighting, P. R. R., 5707 Rippey St., Pittsburgh, Pa. Proposed by J. B. Anderson.

Stoll, H. B., Draughtsman, P. R. R., Twenty-eighth St. and Liberty Ave., Pittsburgh, Pa. Proposed by H. W. Rinehart.

Walter, W. A., Foreman, Blacksmith Shop, P. R. R., P. O. Box 25, Verona, Pa. Proposed by U. G. Detwiler.

Westhaeffer, P. E., Draughtsman, P. R. R., 739 Penn Ave., Wilkinsburg, Pa. Proposed by H. W. Rinehart.

Wetstone, Newton, Chief Clerk, P. R. R., Room 504, 1003 Penn Ave., Pittsburgh, Pa. Proposed by E. M. Craig.

Willoughby, D. J., Clerk, Pressed Steel Car Co., McKees Rocks, Pa. Proposed by G. C. Baldwin.

Wills, J. F., Engineman, B. & O. R. R., Lytle St., Hazelwood Station, Pittsburgh, Pa. Proposed by C. A. Richardson.

Yohe, Curtis M., President, Sorena Oil Co., Inc., West Carson St., Pittsburgh, Pa. Proposed by A. D. Brown.

Yohe, Jay, Assistant General Bookeeper, Penna. Co., Room 408, Union Station, Pittsburgh, Pa. Proposed by H. E. Boyle.

PRESIDENT: As soon as these names have been approved by the Executive Committee, the gentlemen will be admitted to membership.

MR. C. A. RICHARDSON: Mr. President, I would like to call to the attention of the Club a statement made by a well-know railroad official to the effect that steel or metal ties would become popular and in general use when a safe and reliable rail fastner is produced. I am interested in a device of this kind and would like to submit, at one of the meetings of our Club, a paper on this subject, together with models showing the device in question.

PRESIDENT: This matter will be taken up by the Secretary at a later date.

PRESIDENT: If there is no further business at this time we will proceed with the paper of the evening by A. R. Roy, Ph. D., of the Swedish Iron and Steel Corporation.

SWEDISH STEEL (HISTORICAL)

BY A. R. ROY, PH. D.

I would like to preface the reading of the paper tonight by saying that there has been a mistake made in announcing it as "Swedish Steel Versus Other Makes." The paper is entitled only "Swedish Steels," and it deals merely with the history of that steel. It would be presumptious to come down to Pittsburgh, the center of the steel industry, to speak about the quality of one steel in competition with others. There are men among you who have lived within the sound of the hammer and spent your lives on four wheels and two strips of steel. Gentlemen, allow me, therefore, to disabuse your mind. This paper will deal with nothing but the history of Swedish steel and its recognized merit.

The early history of iron began at such a distant period of time that it is impossible to say anything definite about it. Conjectures that would naturally be made would prove very interesting to those who had time to read them, but the executives of great railroad systems find it difficult to get through their legitimate work in the twenty-four hours that is allotted to a day. We know that iron and steel were used by the ancient Egyptians, and before them by the Aryans of India and the sons of the Celestial Empire. Before that—who knows? Did not old Mexico possess a civilization that was a marvel to the Spaniards? If we believe the evidence of recent excavations, the civilization of Mexico is older than any known. Did they not know the use of iron, the commonest of all metals, the metal that is present in everything colored red by nature? It would seem unreasonable to deny this knowledge to any cultured people. But all this is only theory, imagination, that opens unlimited fields to roam in. Space in imagination is an optical illusion. Standing on the bend of the Bramaputra river one can see the triangular peak of Mt. Everest, 250 miles away, and it looks but a stone's throw away. There is no limit to the horizon in imagination, and the most far-fetched theories seem plausible and close to the truth.

The unwritten history of past ages found in the tombs of the great dead, in temples and cities buried underground, point to the use of iron and steel thousands of years ago. A few years ago, while sinking a well in Central Asia, engineers came upon a buried city some forty feet below the surface. That city rested in a cavity and men of the twentieth century walked on the old streets unhindered, entered houses whose masters had been reduced beyond the state of calcined bones to dust. In those houses they found milled coins struck in dies; they found articles of iron and steel. Who were the people that lived there? When did they live? They have passed out of human ken! Even then, with these people, steel and iron were not an unknown quantity. Go where you will in the world and in every country, you will find evidence of the existence of iron and steel in the unwritten ages. Recently a steel tool was found in a chamber of the Pyramids that had not been opened for over 4000 years. Remember the iron pillar in Delhi, India, that has been standing from times immemorial. Cuneiform and runic characters in Persia and Japan, cut on granite, point to the use of steel thousands of years ago. Ah, this old, old world of ours has buried many a secret we shall never know. Atlantis! old drowned Atlantis! Buried cities! Forgotten peoples! Where shall we look for the origin of iron and steel?

Examining written history we find that the Greeks knew the use of steel, to quote J. S. Jean, a historian of steel, "In the time of Alexander the Great (B. C. 355), the manufacture of steel appears to have reached considerable perfection, and to have been varied to suit special circumstances and uses." Daimachus, the writer of this epoch, tells us that "of steel there is the Chalybdic, the Synopic, the Lydian and the Lacedaemonian for files, drills, gravers and stone chisels; the Lydian is also suited for files and for knives, razors and rasps."

But this statement still leaves us in doubt as to when iron and steel—recognized as something different from the former—was first used in Europe. Special steels show that great progress has been made in its manufacture.

As a rule it is possible to arrive at the origin of an article by tracing back the derivation of its appellation to its primal source. In this case, taking the word steel, one can go back no further than the Anglo Saxon styles. Taking the word in Greek, the equivalent is practically "meteorite," hinting at the first possible discovery. Most probably the harder metal was first found in some meteorite that fell in Greece. Enough, however, about the early history of steel. It is not written. Man in his usual forgetfulness of the best and most prolific of Nature's gifts, has failed once more to record the origin of this useful metal.

Most probably no one will ever be able to trace the origin of steel, for it is likely that steel has existed under the name of iron long before it began to be differentiated as a particular metal. After all, steel is only impure iron; that is, iron alloyed with carbon and other elements, and it is reasonable to believe that iron made by the ancients did often contain the impurities that make steel today.

In more recent times we find Europe beehived with iron and steel industries. All through Europe blacksmiths on small scales and manufacturers on a larger scale, were making steel. Spain had made a name for herself. In England there was a great demand for iron and steel, and for two or three centuries people were continually experimenting trying to get a steel that would answer the growing requirements. Those who have read Sir Walter Scott's "Kenilworth," will remember the mysterious figure of the blacksmith working on the hill top trying to make a new kind of steel. There were many such characters in England all through the middle centuries. But it was not until the use of Swedish iron for making steel that we find any kind of a standard steel, a steel that would not cost as much as Wootz steel, that was brought all the way from India. This assertion can be easily proved by any one who would devote a few hours to the reading of the history of iron and steel. After the perfection of the Huntsmen and Bessemer processes, it became imperative to employ Swedish iron in the manufacture of steels of high grade; in fact, it displaced even the Russian irons that were brought from the Ural.

Bradley Stoughton says it is these Swedish products that supply the steel industries of Sheffield with pure material for the tool steel and cutlery. Another author says that Sheffield's celebrity for tool steel is caused and is dependent on the use of Swedish iron. These opinions are not confined only to the insular kingdom, but we found them current all over the continent of Europe to even a greater extent. For instance, while Great Britain alone bought 173,726 tons in 1902, Germany invested in four times that amount, later figures would show a continual increase. These figures are stronger proof than argument that Swedish iron as a base for steel cannot be excelled.

Sweden has for many years confined herself to the export of iron. She has not taken the trouble to sell her steel to foreign countries, not because her steel would not meet the competition in a foreign field for quality, but, as Professor Akerman says, "Sweden found it would pay her better to sell iron, which was in great demand, than expend her capital in producing steels whose price would be greater than steel produced in other countries." These conditions existed up to a very recent date. The government of the country deprecated the employment of foreign capital in her iron and steel industry, but now an enterprising American firm has been able to convince Swedish manufacturers of the fact that they could exploit their steel in the American market to decided financial advantage; and, further, this firm had enough confidence in their opinion to back their suggestion with substantial capital. And now Sweden is sending her steel in enormous quantities to the American market. For instance, there are 4,000 tons of it deposited in one place and under one roof.

Reasons Why Swedish Steel is Considered to be so Good.

It may be questioned, why should Swedish steel be equal to any other good steel on the market?

We have established the fact that there is no better base than Swedish iron for steel. Now, why is Swedish ore the best?

Nature is full of compensations. There is no one country more favored than another. If it appears so, it is only because the inhabitants of one land have made more use of their natural resources than another. Sweden is bleak and mountainous; it is dark and cold; icy blasts from the northern pole cannon down the valleys, turning rivers into skating streaks and covering the land with depths of snow. The freezing ring of the Artic presses heavily on the children of the soil, chilling the marrow of their bones. But Nature made the people hardy and gave them the most suitable wealth. She made the mountains out of iron, she covered the beds of their lakes with purest iron, she filled their valleys with great pine woods with which to work their iron. Consul McGregor computes there are billions of tons of iron ore in the country above the level of the lake. The amount below the level is incalculably immense. England has coal, the best known; Sweden has iron, the best known; Welsh coal is considered best for naval purposes; Swedish iron ore, without a doubt, is the best base for steel. Such is Nature's gift to Sweden, and the whole world of steel knows it.

Sweden has made use of Nature's gift in the best way possible. In smelting the iron ore, the manufacturers use charcoal. In making steel with this iron base, they use charcoal—the purest of all metallurgical fuels. It is the use of charcoal that places Swedish steel in the vanguard. Swedish manufacturers cannot help using charcoal, for there are no coal fields in Sweden. It will be interesting to know that the government will not allow a mill to be opened until it is assured that the mill has facilities in the neighborhood to get the charcoal necessary. This is a most fortunate thing for the world in general, although it may not be for the pockets of the iron and steel masters. The importance of charcoal fuel is not fully appreciated by the ordinary users of steel, yet employment of charcoal fuel is essential for the purity of the finished product. It completely eliminates the infusion of certain elements contained in coal gas into the steel, deteriorating the quality of the product. It is very possible, more than probable, unless some new method of process were discovered, that Swedish steel would not so outclass other steels if coal instead of charcoal was used as a fuel, and this fact is worth keeping in mind when judging the qualities of various steels.

In the eleventh edition of the Encyclopedia Britannica, Henry Marion Howe, A. M., L. L. D., Professor of Metallurgy, Columbia University, says:

"Sweden has abundant rich and very pure iron ores, but lack of coal has restricted her iron manufacturers chiefly to the very purest and best class of iron and steel, in the making of which her thrifty and intellignt people have developed very rare skill."

The manufacture of smaller quantities is claimed to give a greater evenness in quality and homogenity, for the simple reason that heat can be distributed evenly through a smaller amount of matter more readily than through a greater mass.

Besides this, the greatest care is taken in the manufacturing of steel, because of the use of charcoal, and this very use of charcoal is also a reason for the very small converters which are used. Charcoal is far more expensive than coal, because of the labor of producing it, and its limitation of quantity is natural. Still greater care is taken in turning out the finished product for the market, as much as 35% of the ingot being removed so as to insure the elimination of all imperfections and irregularities. Thus only the very core of the billet is placed on the market; the quality of the steel is assured, also the reputation of the maker. In America, living at the rate we do, we are often unable to pay the attention to detail which marks masterpiece or endurance in time and fame. For instance, in Switzerland they temper fine tools only at night, to be sure of the passing colors. Such a thing would be almost preposterous in America. In the same way the thrifty Swede works the steel in his own careful, skilled way, with due regard to tradition and custom, and turns out a steel equal to any made with all our modern improvements. Here it is interesting to note that the manufacture of steel in Sweden seems to run in families. The son takes up the work of the father and carries it on to the best of his ability, and so on it goes from century to century. Thus it will be noticed that the manufacture of steel is almost hereditary and so also the knowledge that goes with it. The experience and knowledge of centuries must be of some worth.

A further reason for the excellent quality of Swedish steel is the presence of the vanadium in the iron ore. This statement is made with caution and reservation. The claim has been often made that there is vanadium in Swedish steel, but analysis shows no trace of it. There, however, is not much doubt of the presence of that metal in the native ore. Its absence in the anlysis of steel may be explained by the following quotation from O. M. Becker: "Some of the vanadium is lost, probably, by passing into the slag, together with the oxygen which it removes."

If this be the case, the extraordinary purity of Swedish steel can be easily explained, for the vanadium is not lost until it has imparted to the steel its peculiar beneficient effects.

It will be interesting to learn exactly why and what vanadium does to steel. The following quotation was taken from Harper's Weekly, September 2, 1907: "A number of photographs were taken, which showed the cross section of a bar of vanadium steel enlarged many times, and it was seen that each molecule was securely linked to the next by an arm or a claw. The entire structure was, so to speak, knitted together. This is not the case with even the best grades of chrome nickel steel. This interlocking of molecules, he believes, is what gives vanadium steel its peculiar fatigue-resisting qualities. This, although an unusual theory, sounds plausible. Certain it is that vanadium steel is exceedingly strong. If, then, some of the Swedish ores contain a certain amount of vanadium, it is quite likely that their toughness and strength can be largely accounted for by its presence."

We may then sum up the reasons of the fine quality of Swedish steel thus:

First—Because Nature gave Sweden the best iron ore in the world.

Second—Sweden, having no coal beds, is compelled to use charcoal, the purest fuel in metallurgical manufacture.

Third—Sweden manufactures in small quantities.

Fourth—Sweden uses the greatest care in manufacturing, because of its expensive fuel.

Fifth—The presence of vanadium in the iron ore.

Sixth—Because Sweden takes the greatest care in allowing none but the most perfect of her products to be placed on the market.

Although Sweden undoubtedly makes a steel equal to the best in the world, much of it is not exported out of the country, because:

First—Swedish iron is so much in demand that it pays better to sell the iron than to enter largely into exporting steel.

Second—The necessary foreign capital for engaging in an international steel competition was lacking because the government of the country disfavored the use of foreign capital up to a very recent time.

Now, however, Sweden is expanding her field of action for steel. Enterprising Americans have convinced them of the vastness of the American field and the interest of catering to it. They have invested money to stock large quantities of Swedish Steel and exploit them on the American market, and everywhere their efforts are meeting with an unqualified success.

That last sentence brings this paper to an end, and I hope that it has served the purpose for which it was written. It was desired merely to recall to your mind the excellence of Swedish iron and steel—a fact which you all recognize and know. Further, to tell you the history of the Swedish products. These things are interesting to you, but we fully understand that you have not the time to read all about it.

Gentlemen, I thank you for your attention.

PRESIDENT: Is there any one who would like to open any discussion on this subject or ask Mr. Roy any questions? Dr. Unger, we would like to hear from you on this subject.

MR. J. S. UNGER: Mr. President, I have been very much interested in listening to the paper of Mr. Roy, and while he was giving us the historical description of the manufacture of iron and steel, it occurred to me that he omitted to put into that history the earliest record we have of iron, which we find in the fourth chapter, twenty-second verse, of Genesis.

It is true that Nature has given Sweden a very pure ore. The reduction of any pure ore by means of pure fuel, such as charcoal, must certainly result in a very fine product.

I suppose many of you have read the early history of the manufacture of iron in this state. At that time they used charcoal as a fuel. Our local ores are not of as high a degree of purity as the Swedish ores, but the product was quite satisfactory.

Later developments have shown the manufacturers the way to use coal, or coke—a product of coal—as fuel. Coke, as we all know, is a more impure fuel than charcoal and could not produce the same quality of product. Our ores from the Northwest, however, are purer and the iron now produced is superior to that manufactured many years ago. By our present processes of manufacture we are producing a very pure steel. The Basic Bessemer process is a highly purifying one, but not used in this country. The basic open hearth process is in the same class. A recent process that has been introduced into the country has been the electric manufacture of steel. This admits of a high degree of purification.

It seems to me that 35% discard should result in a very fine product. This appears to be an excessive discard for a material of as high a degree of purity as is claimed for Swedish iron and steel.

I must take issue with the author of the paper on the importance he gives to the presence of vanadium in the Swedish ore. It is true that it does exist, yet by the ordinary method of extracting iron from the ore, it is hardly probable that any Vanadium is reduced in the Swedish ores. Since the analyses fail to show its presence in the finished product, I do not think it has been of much benefit.

PRESIDENT: May we hear from Mr. Barker, of The Firth-Sterling Steel Company?

MR. A. E. BARKER: I think Mr. Roy has covered the field very well.

PRESIDENT: Are there any others that would like to speak on the subject?

MR. D. J. REDDING: Mr. President, I would like to have Mr. Roy tell us why the Swedish manufacturers consider it necessary to discard so large a quantity of their billets as 35%.

I gather from his remarks that the Swedish government exercises more or less control over the manufacture of steel, inasmuch as they will not permit the establishment of plants except at certain places. Is there really such a thing as government supervision over the manufacture of steel, and if in the event of the large increase in output, due to the latter-day methods, which we are assured are now being introduced, is there any assurance that this practice will be continued, or will the manufacturers do like some others, and only make the steel good enough so that it will get by the inspector?

PRESIDENT: Mr. Roy, can you answer the questions asked by Mr. Redding?

Mr. George P. Toby, President of the Swedish Iron and Steel Corporation, answered for Mr. Roy.

MR. TOBY: Regarding steel, Swedish steel, I can only speak from knowledge which I have gained by my visits to Sweden during the last year and my study of the conditions there.

That 35% is taken from the product is a fact, not in all cases, but in quite a number of instances to which we can refer. Of course, it does not apply to all cases, it is true. However, this is the practice of certain mills who aim at producing the best.

Now, the government's provision that you speak of would probably take us back to early history, about 1450.

The timber interests of Sweden are larger than the steel interests and in the early days some of the estates that are still in existence ranged from five to twenty-five miles long and from a mile to three miles wide. These were formerly in the hands of the aristocracy of Sweden and its interests were the main interests of the country.

The iron industry was a secondary consideration at that time. Probably, therefore, the government would not allow a mill to be opened unless it was assured that there was enough timber in its environment to be able to supply the fuel for the mill. In this way both the interests were taken care of, and perhaps because of the aristocracy being so closely connected with these two interests, the government of the country deprecated the employment of foreign capital.

I was in a number of mills, one of them the Osterby mill, which was opened in 1550, and there I saw mines belonging to it, about 1200 feet in depth. Besides this mill, I visited other mills, one of which was opened in 1650. These mills today still produce iron of the same quality. This is due to the fact that the same quality of ore and practically the same methods of manufacture are used today as when they began. The Osterby plant is operated by Walloons, who are a people peculiar to themselves and different even from the Swedes. They have passed their art of iron and steel making down from one generation to another. These Walloons are seldom known to engage in any other industry save that of iron and steel making. It seems to be almost a matter of caste with them.

Now, I am going to show how different the conditions are in Sweden from what they are in this country. About two years ago there was a strike in Sweden among the iron and steel workers. The strike was prolonged over a period of five months. It was decidedly socialistic. The idea was that they were going to control the Government, and in several instances the manufacturers went so far as to tell the strikers that their demands would be acceded to—as soon as they got control of the Government. I believe in one place there were 1,350 men employed; at the end of the strike all but 25 of this number were taken back into employment. I mention these figures to show how closely allied are the interests of the manufacturer and the workman. It would appear that neither could do without the other. The strength of the manufacturers' position is shown by the fact that the very home of the workmen are given to them, schools and churches are built for them, and everything put in their way. Thus the manufacturer has complete control over the life and welfare of his workmen; yet they took back all but 25 men. It is evident that the manufacturer wanted these workmen, because these workmen are undoubtedly the best iron and steel workmen in the world. It may be called a hereditary gift. On the other hand, the weakness or dependence of the workman is shown by the fact that, although the strike lasted five months and they were almost in a starving condition, yet all but 25 of the 1,350 men refused to enter into another line of industry—a very forcible evidence that these men, so perfect in iron and steel making, knew no other trade to which they could turn their hands in a case of emergency. These are conditions which aid and insure the quality of iron and steel produced in Sweden and they are somewhat different from the conditions that exist here.

There is another condition, a very important one, which marks the difference between the two countries, and this is the quality of the native ore and the timber found in Sweden. These the Lord gave them—and it is a *condition.* And the high quality of the iron we speak of is simply Nature's condition, and I believe the quality, that high quality, will always be sustained because they cannot get away from it.

If the American steel maker went to Sweden he probably could materially improve what they have. If he could bring the product here and turn it out in American mills to a commercial advantage, there would be no telling what could be done. However, I believe the quality of Swedish steel will always be as it is now, because they cannot change it on account of the small quantities in which they produce it and the quality of the ore and the charcoal fuel that they are compelled to use; and since Swedish steel began to be properly exploited in this country from a small beginning, it has grown to be a factor in the American steel market, a factor that compels attention.

Now, gentlemen, I have here a few photographs from Sweden showing some furnaces, some ancient methods of manufacture, and a very antiquated-looking hammer. I do not believe you will find in all America such pictures, and I have no doubt that they will be of absorbing interest to you. I will just hand them around.

PRESIDENT: Are there any others that would like to speak on the subject or ask any questions?

MR. REDDING: Mr. President, as there seems to be no desire for further discussion, I would like to say that we feel we have all been benefited greatly by listening to the reading of this paper. I think that perhaps everyone who has anything to do with the steel business, or the use of steel, has known in a general way that Swedish iron is particularly good iron, and the speaker has illuminated the situation with his explanation as to the natural purity of the iron and the methods of manufacturing, and I would offer a motion that we extend to Mr. Roy a vote of thanks for his very able paper.

Motion seconded and unanimously carried.

MR. ROY: Gentlemen, I thank you.

ON MOTION, Adjourned.

ESTABLISHED 1891
EDWARD KERR, President

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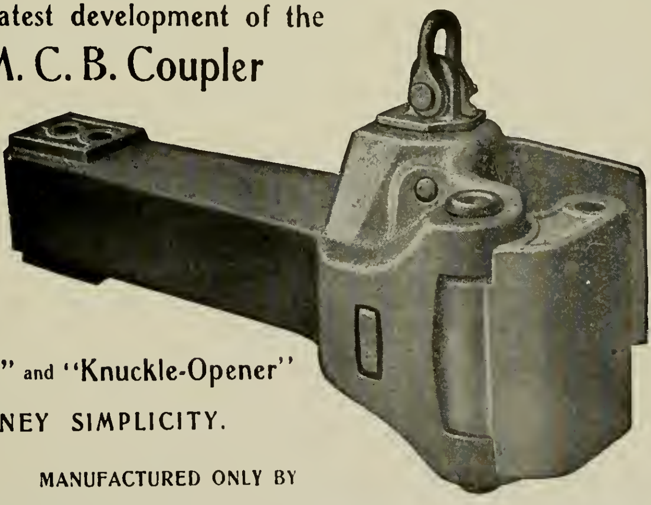

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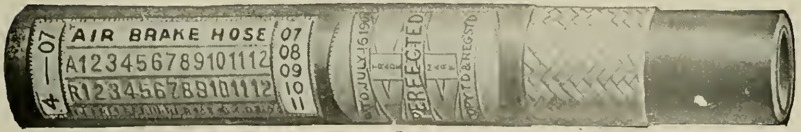

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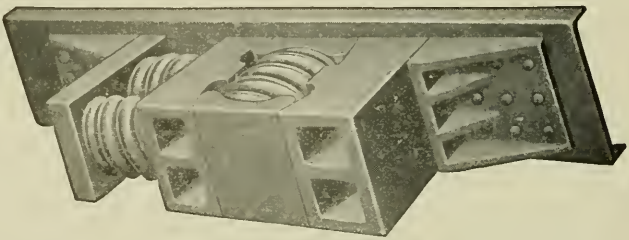

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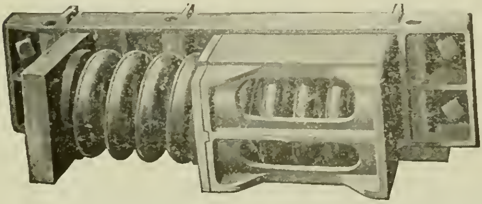

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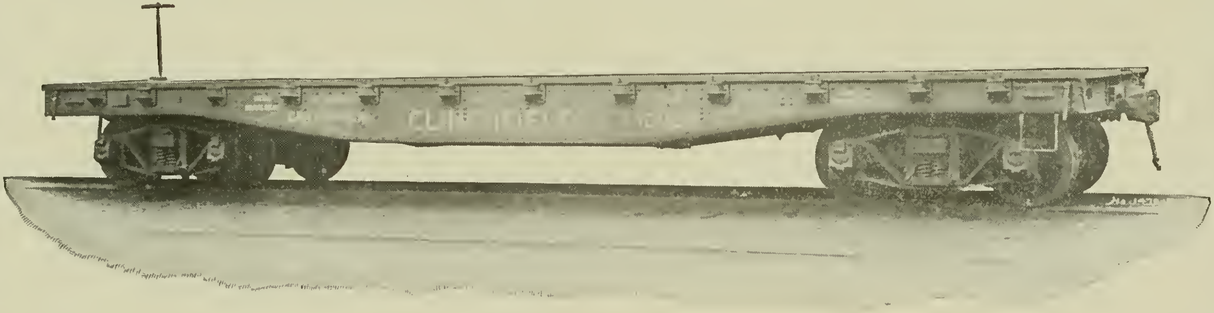

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*No. 2.

What the Actual User Says About the Steel Boiler Tube

℄ The Fifth Annual Convention MASTER BOILER MAKERS' ASSOCIATION was held at the Rome Hotel, Omaha, Nebr., May 23, 24, 25, 26, 1911.

℄ The Committee previously appointed reported on the subject of **"Steel vs. Iron Flue. What Advantage and What Success in Welding Them and the Effect of Tube and Maintenance."**

℄ Considerable interesting discussion ensued.

℄ For example: The Foreman Boiler Maker of one of the largest Eastern Railroads spoke as follows: (THE BOILER MAKER, June, 1911, page 167).

> (Mr. ——) "I hear people speak of steel flue with regard to welding, that they couldn't weld them, that they spread, and all that sort of thing. We have used not only the Spellerized (Lap-Weld), but the Shelby (Seamless), and we have had no trouble in welding them at all."

℄ For years we manufactured the charcoal iron tube. Becoming convinced, however, by our own experience and the reported experience of many users that the steel tube was exactly what the name implies—THE MODERN BOILER TUBE—we abandoned the manufacture of the iron boiler tube and are devoting our entire attention to the steel tube.

℄ The Steel Boiler Tube represents a triple economy as follows:
(1) Saving in first cost.
(2) Saving in maintenance expense.
(3) Greater mileage—less cost per mile.

℄ We manufacture two types of Steel Boiler Tubes:
(a) Spellerized Lap-Welded Tubes.
(b) Shelby Seamless Tubes.
Each type has peculiar advantages under specific conditions.

℄ Your requirements may be peculiar, by reason of bad water or exceptional conditions. We have helped to solve many boiler tube problems of this kind, and will be glad to give you the benefit of our experience.

℄ Others have materially reduced their boiler tube expense by the use of THE MODERN BOILER TUBE.

℄ WHY NOT YOU ?

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*This is the second of a series of announcements containing an opinion of an actual user of the Steel Boiler Tube.

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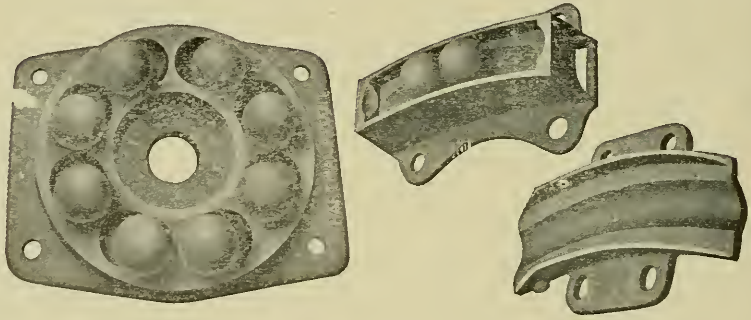

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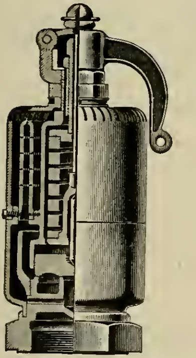

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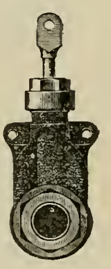

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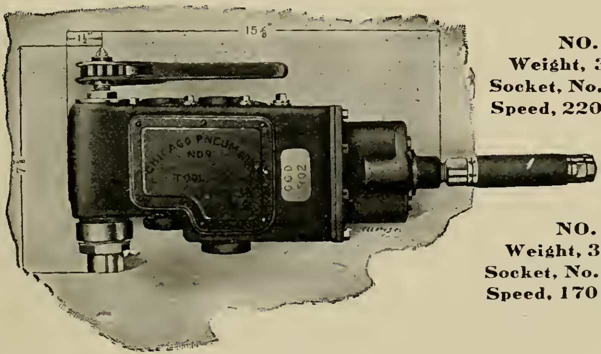

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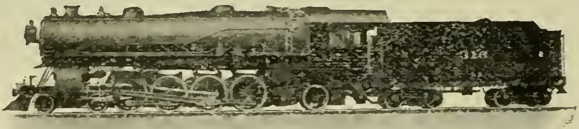

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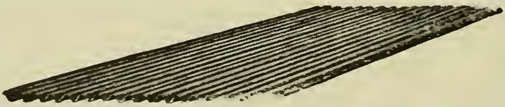

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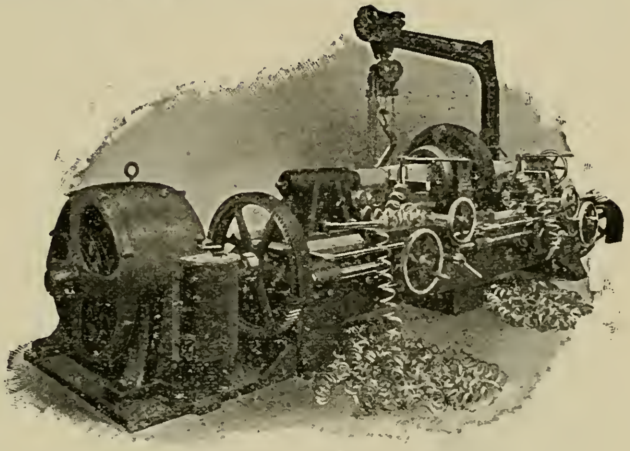

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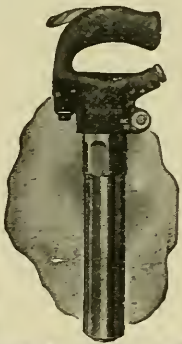

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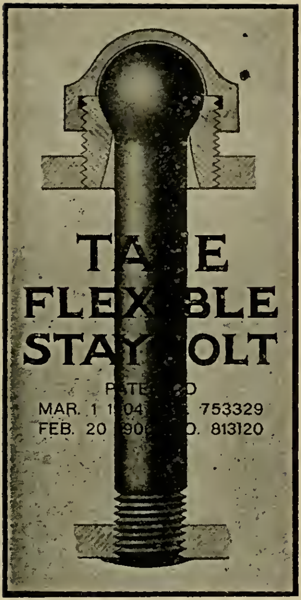

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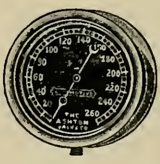

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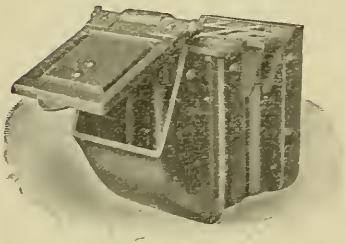

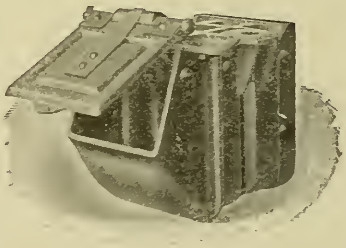

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ORGANIZED OCTOBER 18, 1901.

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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING, DECEMBER 22nd, 1911.

The meeting was called to order by President F. R. McFeatters at 8 o'clock P. M., at the Monongahela House, Pittsburgh, Pa.

The following gentlemen registered:

MEMBERS.

Albree, C. B.
Allison, John
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Crouch, A. W.
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Detwiler, U. G.
Drane, E. J.
Dunlevy, J. H.
Dussel, F. E.
Evans, H. E.
Foreman, J. E.
Frame, R. S., Jr.
Franey, J. F.
Gale, C. H.
Geddes, Jas. R.
Gilg, Henry F.
Griswold, W. W.
Grove, E. M.
Gutierrez, S. J.
Harriman, H. A.
Heady, T. B.
Herlehy, Thos. W.
Hoffman, C. T.
Howe, D. M.
Hudson, W. L.
Hyndman, F. T.
Kaup, H. E.
Kennedy, Jas.
Keptner, J. B.
Kessler, D. D.
Kewley, E. C.
Kinter, D. H.
Kirk, T. S.
Knapp, A. D.
Knight, E. A.
Koch, Felix
Lobez, P. L.
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Macfarlane, W. E.
Mackert, A. A.
Malloy, M. A.
Mason, Stephen C.
Mensch, E. M.
Michel, William J.
Millar, C. W.
Miller, F. L.
Morse, R. C., Jr.
McCauley, Wm.
McFeatters, F. R.
McNulty, F. M.
O'Brien, W.
Orner, M. T. S.
Pechstein, A. J. G.
Pfeil, John
Pfister, A. J.
Pitcairn, N. B.
Rabold, W. E.
Ranck, J. M., Sr.
Rea, C. S.
Ream, A. H.
Rinehart, H. W.
Robinson, S. R.
Ryan, Wm. F.
Sampson, J. M.
Sargent, L. L.

Sattley, E. C.
Schauer, A. J.
Scheck, H. G.
Schiller, John
Schultz, Geo. H.
Scott, W. A., Jr.
Smith, A. D.
Smith, A. H.
Smith, C. E.
Smith, Geo. H.
Smith, M. A.
Smith, Russell
Stafford, Saml. G.
Stark, F. H.
Stewart, S. R. B.
Stucki, A.
Thomas, E.
Walter, W. A.
Wetstone, Newton
Wills, Jas. F.
Zinnmaster, F.

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Bittner, S. L.
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Taylor, F. C.
Taylor, S. A.
Whitesell, S. B.
Wright, L. S.

The reading of the minutes of the last meeting was dispensed with, they being in the hands of the printer.

The Secretary read the following list of applications for membership:

Adams, Chas. B., Engineer of Construction, Pressed Steel Car Co., Euclid Apartments, Bellevue, Pa. Proposed by H. E. Kaup.

Anderson, Hans S., Assistant Mechanical Engineer, H. K. Porter Co., 225 Millvale Ave., Pittsburgh. Proposed by Karl Berg.

Bakewell, D. C., Rep., Duquesne Steel Foundry Co., Arrott Bldg., Pittsburgh. Proposed by H. V. Porter.

Delaney, V. C., General Yard Master, Youngstown Sheet & Tube Co., Youngstown, Pa. Proposed by C. L. Hinsdale.

Dietrich, W. S., Pressed Steel Car Co., 6952½ Mt. Vernon St., Pittsburgh, Pa. Proposed by H. E. Kaup.

Eddy, W. J., Tool Inspector, Erie Ry. Shops, Meadville, Pa. Proposed by M. O'Connor.

Elverson, H. W., General Foreman, Misc. Order Dept., Pressed Steel Car Co., McKees Rocks, Pa. Proposed by H. E. Kaup.

Frazier, Edward L., Jr., Draughtsman, Penna. R. R. Co., Verona, Pa. Proposed by W. A. Walter.

Hankey, Elmer B., Chief Rate Clerk, Penna. R. R., Room 222, Union Station, Pittsburgh, Pa. Proposed by W. A. Walter.

Higgins, H. L., Clerk, Penna. Lines West, 1009 Union Station, Pittsburgh, Pa. Proposed by J. B. Anderson.

Hurley, Theodore, Foreman, Penna. Lines West, 3514 Massachusetts Ave., Pittsburgh, N. S. Proposed by E. A. Beatty.

Jones, Rees, Clerk, Penna. R. R., 220 Giffin Ave., Mt. Oliver, Pittsburgh, Pa. Proposed by J. A. Cook.

King, Wm. R., Salesman, Firth-Sterling Steel Co., 1422 Oliver Bldg., Pittsburgh, Pa. Proposed by A. E. Barker.

Kitchen, R. R., Manager, Jas. Stewart & Co., 1644 Oliver Bldg., Pittsburgh, Pa. Proposed by John Pfeil.

Perry, W. E., Asst. Chief Clerk, Penna. Lines West, 1009 Union Station, Pittsburgh, Pa. Proposed by J. B. Anderson.

Ralston, A. L., Salesman, Crucible Steel Co. of America, 1912 Oliver Bldg., Pittsburgh, Pa. Proposed by W. A. Walter.

Redding, J. K., Supervisor, Penna. R. R., Dravosburg, Pa. Proposed by M. A. Malloy.

Reid, David K., Mechanical Engineer, Atlantic Refining Co., 265 Forty-sixth St., Pittsburgh, Pa. Proposed by F. L. White.

Sharpley, Horatio C., Master Blacksmith, American Locomotive Co., 48 Kendall Ave., Bellevue, Pa. Proposed by E. A. Beatty.

Shourek, Theo. L., Draughtsman, Penna. R. R., 811 East View St., Pittsburgh, E. E. Proposed by J. B. Anderson.

Sivitz, Wm. I., Assistant Chemist, Duquesne Steel Foundry Co., Centre and Vine Sts., Pittsburgh, Pa. Proposed by A. D. Smith.

Smith, John, General Foreman, Boiler Shop, P. & L. E. Ry., McKees Rocks, Pa. Proposed by M. O'Connor.

Parkinson, H. D., Clerk, Pressed Steel Car Co., McKees Rocks, Pa. Proposed by H. E. Kaup.

Taylor, Frank C., Assistant General Car Inspector, Penna. R. R., 206 Union Station, Pittsburgh, Pa. Proposed by J. B. Anderson.

Wright, L. S., Assistant Superintendent, Pressed Steel Car Co., 615 Cliff St., Bellevue, Pa. Proposed by H. E. Kaup.

PRESIDENT: As soon as these names have been favorably passed upon by the Executive Committee, the gentlemen will become members.

The Secretary announced the death of Mr. Frank M. Townsend, a member of this Club. Whereupon the President appointed as a Committee to draft suitable memorial resolutions the following gentlemen: L. C. Bihler, W. J. Bogert and J. H. McAdoo.

PRESIDENT: If there is no further business to come before the Club, we will proceed with the lecture of the evening. I now present to you Mr. Samuel A. Taylor, who has made a visit to the Panama Canal and who will tell us about it. He is amply able to answer any questions on the construction work which you may desire to ask, and requests that questions be asked as the pictures are shown, in order that he may reply while the picture is before you.

PANAMA CANAL

BY MR. S. A. TAYLOR

MR. S. A. TAYLOR: I wish to say, by way of preface, that my trip to the Canal was made in connection with the American Institute of Mining Engineers, who had received from President Taft an invitation to hold their annual meeting on the Zone, to examine the work, investigate it thoroughly, ask any questions they might desire and make any suggestions they choose. And instructions were given that we should be afforded every facility for examination of the work, which was accorded to us in a right royal manner. A special train was placed at our disposal, and we were taken all over the work, even down into Culebra Cut, where only once before had such a thing occurred, and that was when the Congressional Investigating Committee visited the Zone.

The main object to be obtained is the construction of the Canal, and everything else is made subservient to that. It makes no difference whether a passenger train is due at a certain point at a certain time or not, if there is some work in connection with the Canal that is going to be held up by permitting the passenger train to reach its destination on time, the passenger train must wait. It does not seem to have right of way, but the work train does.

The construction of an Isthmian Canal has been before the public for many centuries in one way or another. In early history the Spaniards were the first to be attracted by the idea of a western passage to India. In Dr. Julius Fletcher Johnson's book, "Four Centuries of the Panama Canal," is a quotation from Galvano, made on the authority of Aristotle, as follows:

"In the year 590, before the incarnation of Christ, there went out of Spain a fleet of Carthagenian merchants, upon their own proper costs and charges, which sailed toward the West through the high seas to see if they could find any land; and they sailed so far that they found at last the islands which we now call the Antilles and New Spain; which Gonsalvo Ferdinand de Oviedo saith were then discovered; although Christopher Columbus afterwards, by his travel, got more exact knowledge of them and hath left us an evident notice where they be. But all of these historians which wrote of these Antilles before as of doubtful and uncertain things, and of places undiscovered, do now plainly confess the same to be the country of New Spain."

Columbus on one of his journeys landed at Colon, and on his fourth voyage he claims to have gone up the Chagres River as far as Bas Obispo, which is now the entrance to the great Culebra Cut. His idea was that there was a through passageway where the canal is now. And this is shown on an old chart of the world according to Waldseemuller, dated 1596. Cortez, in 1529, began to doubt the existence of a natural waterway and to consider the practicability of an artificial canal. And it is interesting to note that from the very outset, of the nineteen different routes that have been considered at one time or another, contest as to feasibility has centered around the Panama and Nicaraugua routes.

Philip II. of Spain, in 1557, caused a survey to be made of the Nicaraugua route. The reports of the engineers commissioned to pass on the proposition were so unsatisfactory that the matter was referred to the clergy, who in those days were supposed to be the possessors of all kinds of knowledge. After considerable squabbling, they found a passage in Scripture, "What God hath joined together let no man put asunder," and they decided that this passage applied specifically to the Isthmian Canal, so that was the end of it for many centuries, until DeLesseps, fresh from the successful accomplishment of the Suez Canal, heaped with laurels, undertook to construct the Panama Canal on behalf of the French.

The history of the French in connection with this venture is one of dismal failure. The brilliant success of DeLesseps with the Suez Canal gave him unlimited financial backing and credit, which led to the extravagance and graft which, with disease, led to inevitable failure.

Then came some years of history with which we are all more or less familiar, when our government purchased the holdings of the French company for $40,000,000 and added to that another $10,000,000 to the Panama government, which had been formed practically for the purpose of negotiating this agreement, making a total of $50,000,000 which our government paid for the canal property, franchises, etc.

I want to call your attention to one very impressive fact in passing. The Spanish-American war resulted in the downfall of the Spanish government in the western world. Our own government in carrying on this war, through their occupation of Cuba and the necessity of making it a safe place for habitation, was the first to discover the cause and prevention of yellow fever, the principal source of sickness and the one which must absolutely be overcome before the Panama Canal could be biult. No mention of this would be complete without paying a tribute to the three young army surgeons who made the discovery and worked it out to a practical solution, two of them giving up their lives in the effort. The ridding of the Canal Zone of the mosquito, which we now know to be the cause of the spread of yellow fever, is accomplished by clearing the district of vegetation and treating all the stagnant pools, that cannot be drained off, with a solution of oil and carbolic acid, and also similarly treating all water courses and all places where it would be possible for the mosquito to deposit her larvæ, and maintaining this condition for some distance back from the habitation and place of work on the Zone. The grass has to be cut about once in two weeks, and will grow about two feet in that time. The reservoirs of water are carefully policed every day, the water sheds purified, and the water filtered, and thereby dysentery and its correlated diseases have been almost eliminated. Too great credit cannot be given the Sanitary Department for its tremendous work and brilliant success; for the Zone is now, according to statistics, a much healthier place than many, if not most, of our cities.

The employees are housed free, but pay for their board according to the wages they earn, on a sort of sliding scale.

QUESTION: What is the difference in the food furnished them, or is there any difference?

MR. TAYLOR: I can not tell you exactly. The food of the negro is largely vegetable. They do not care much for meat. They will take soup, but prefer to eat bananas, pineapples, oranges and fruit of all kinds, which is very plentiful and not expensive. The feature of this is that they have estimated the wages of the men by the actual amount of work they can do. A man living on that kind of food would not handle a pick and shovel nearly as well as a man who is eating solid foods. The Spaniard eats more meat. He gets more wages. And they have estimated his wages higher because of the greater amount of work he can do. The government runs two hotels, at which the charges to strangers equal about $5 per day. The so-called "gold" employees, those paid in gold, the Americans, get their meals for about 33c on their books of meal tickets which are issued to them and which are not transferable.

The commissary department is organized on a regular military basis. At Colon, the sea port, all perishable goods are immediately put in cold storage. Each day about 4 o'clock the householders must telephone in their requisitions for the next day. The commissaries send in their requisitions about 5 o'clock, and the cold storage employees immediately begin to load up the trains, and by 4 o'clock the next morning every order is filled and the train starting across the Isthmus. Every one in the Zone gets practically what he wants for one day's living at a time.

QUESTION: Is a colored man permitted to go in the hotel?

MR. TAYLOR: Yes, but his book of tickets is not good and he must pay visitors' rates. The meal ticket books of the Spaniards and the negroes are not good in the hotel.

QUESTION: How many hours constitutes a day's work?

MR. TAYLOR: Eight hours. That is one thing that has changed the cost of the Canal. The original estimates were made up on a basis of ten hours a day. After they began the work, Congress passed a bill making eight hours a day's work on all government work. The estimated cost of the Canal was, of course, immediately increased to correspond with that increased cost of labor.

There is one thing about the Canal that comparatively few people know. The southern end of the Canal is 28 minutes of latitude east of the north end, so that instead of running east and west, as most people believe, the Canal really runs slightly northwest and southeast, the course being 28 minutes east of south.

There has been a great deal of discussion in the newspaper and elsewhere about the slides that occur in the banks of the

Canal. The fact is that we are not following strictly the course of the old French canal, and the French in their excavations threw the dirt wherever it was the most convenient to deposit it, at the sides of the cut, and we have worked through some of their fills, and this is largely the material that is coming down into our excavations.

QUESTION: How do they plan to work the ships into the locks?

MR. TAYLOR: As they come into the locks they are taken hold of by four electric locomotives, which run along the top of the lock walls on tracks, and are towed through. They are not allowed to go through under their own steam. It is estimated that it will take the smaller vessels eight or nine hours to go through from ocean to ocean. The larger vessels, which will occupy almost the entire lock chamber in passage, will take ten or eleven hours. The locks are divided by gates at about a third their length, and only a section of the lock is used, depending on the length of the vessel, thus using less water than if the whole lock had to be used for a small vessel.

On the subject of water, the rainfall is exceedingly heavy. The record was reached a week or so ago when an inch of rain fell in an hour. It is estimated that the rainfall is sufficient to supply the locks with all the water required for continuous use, and enough more to furnish all the electric power used for the various purposes of the locks, traction, light, etc.

The railroad operation is so arranged that all the loads through the cut from the shovels go in one direction on one track, and the empties are taken around on an outside track, so they will not interfere with the movement of the loaded trains. They have a few semaphores, mostly dwarfs at that, but the trains are run in a way that puts it up to the flagman to get back in case the train comes to a stop, and it is up to the engineer to keep a constant lookout for the train ahead of him, and that constant vigilance seems to be the leading spirit of the work. On the return, after unloading at the big terminal yard, as you might call it, at the end of the cut, as the train of empties comes to the head of a sort of ladder track, the engineer signals the dispatcher, who has a little house at the side of the track, what shovel he is serving, and the proper switch is thrown to send him back to his proper shovel.

The shop work on the railroad is also under military organization. Every day reports must be made by telephone of any repairs or parts needed, also of the amount of coal needed, and the repair train is made up with the things required and started out at night, and by the following morning everything is again in good first class shape for work.

QUESTION: What kind of locomotives are used?

MR. TAYLOR: They have various kinds. A great many American locomotives. They are practically all steam, though, of course, they have some electric locomotives around the shops. They have a number of old French locomotives in use for shifting purposes. They are very light, but quite efficient. Also they have quite a number of old French dump cars. All the machinery the French had was of the very finest, and there are millions of dollars worth of the finest machinery to be seen in the ditch and jungle. For instance, the boilers have copper tubes, and everything else was on the same scale of extravagance.

They have in use on the tracks a machine that will be of interest to railroad men—a track mover. When the fill has been made to such a width that they wish to move the track over, the track mover, consisting of heavy chains and hooks hanging from the end of a boom, takes hold of the track and lifts it until the ties are clear of the ground, then a side arm, in which is placed a pulley on which a wire rope passes, having hooks attached to the end, is then fastened to the rails. This rope is operated by a small engine, which swings it over to its new position. That machine displaces a great deal of labor and is very economical in labor and cost of operation.

One of the most interesting features of the Canal Zone is the first Plate Girder Bridge built in the world. It was built by the West Point Foundry Co., New York, and was erected on the old Panama Railroad in 1857. The span has been reduced on account of the heavy engines which now pass over it above the weight for which it was designed. You will notice the upper chord is curved. Colonel Hodges told me that he had his bridge engineers take the measurements of these girders and calculate the stresses, and he says it is absolutely up to the latest practice. That speaks well for the original plate girder. There are four spans of this bridge, two of them in the original position. The other two were taken out and put in a new construction of the railroad which passes around the Culebra Cut. As originally designed, this Panama Railroad was to pass through the cut on a berm on the side, but when they encountered the great slides it was found to be impracticable.

QUESTION: How many yards do the large concrete mixers hold?

MR. TAYLOR: I do not know exactly. I would take it to be about five yards in each mix. They have put in an average of about 3500 cubic yards of concrete a day in the Gatun locks alone.

QUESTION: Are these mixers continuous mixers or batch mixers?

MR. TAYLOR: They are batch mixers, but kept in practically continuous operation. There are six or eight of these mixers in a line and a track passes in front of them. The materials are brought up and deposited in each one of the mixers. The cars are arranged so that they will empty every other mixer, so that while a train of cars is emptying every other mixer, the remaining half are being charged and mixed and by the time one train gets loaded and passes out another train comes in and the second batch is ready to deposit in those cars; so that it is a continuous performance, but the batch is mixed separately.

The speaker illustrated his lecture with a number of stereopticon views describing the design, method of construction, location, etc., of the locks and the various other structures connected with the constructing or operating of the Canal, various types of machinery used, with some detail of their construction, the progress of the work at its various stages, and generally the preparations that have been made, the precautions that have been taken, and the means employed for the safety and health of the thousands of employees, thus giving the Club a very intimate as well as comprehensive knowledge of the work of our government in the Canal Zone.

MR. F. H. STARK: I believe the officers and members of the Railway Club of Pittsburgh should congratulate themselves upon their good fortune in having secured so able an engineer to favor us with this most instructive discourse. Most of us have read magazine articles, and we have heard Representative Barchfield give his volume of statistics, and one of the Congressmen who was a member of the Congressional Investigating Committee has also favored different audiences with descriptions of the work done, but at no time have we been favored with so complete a description as we have heard tonight. I am sure that we all have enjoyed the evening and it has been full of instruction. I would, therefore, move a vote of thanks to Mr. Taylor, to be expressed in a rising vote.

The vote being taken was unanimous.

PRESIDENT: Mr. Taylor, accept the thanks of the Club.

At 10:45 the meeting adjourned.

In Memoriam

FRANK M. TOWNSEND

Frank M. Townsend, General Agent of the Colorado Midland R. R., at Pittsburgh, a member of The Railway Club of Pittsburgh, died November 25th, 1911, in his fifty-third year. He came from a family of railroad men, being the son of Oscar Townsend, for a long time President of the C. L. & W. R. R., and also associated with the old "Bee" Line (Cleveland, Columbus, Cincinnati and Indianapolis). Mr. Townsend during his lifetime served in a number of railroad positions on the C. L. & W. R. R., later becoming associated with the Gulf Petroleum Company, and lastly with the Colorado Midland R. R. as General Agent. He was a member of the First Presbyterian Church, a good husband and kind father, and is survived by his widow, son and daughter. He became associated with The Railway Club on April 28th, 1911.

In his various vocations he served faithfully and well, and had a character and disposition that made him many friends.

On behalf of The Railway Club of Pittsburgh, the Committee asks that this minute be spread upon the records of the Club and a copy sent to the family of Mr. Townsend.

L. C. BIHLER,
JNO. H. McADOO,
WM. J. BOGERT,
Committee.

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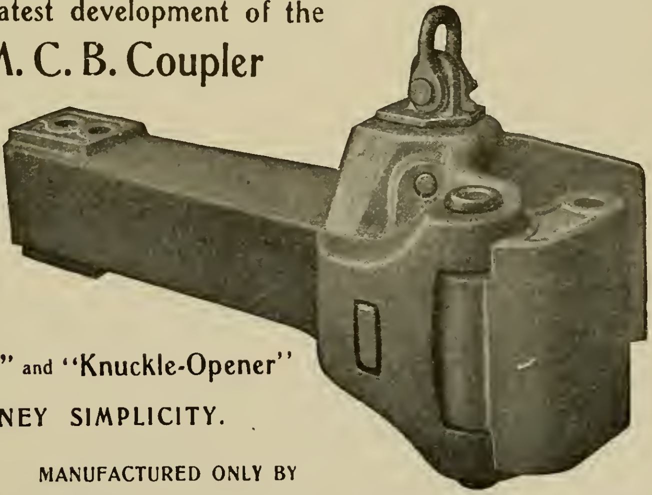

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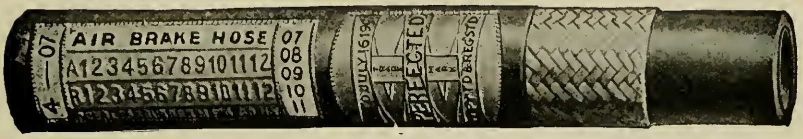

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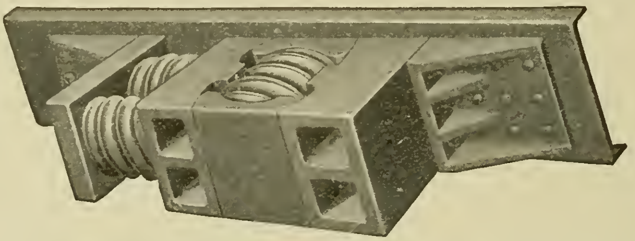

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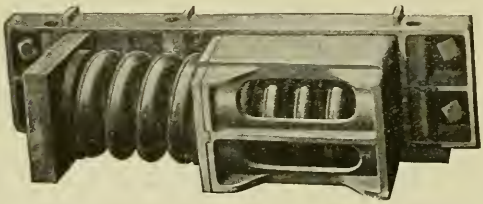

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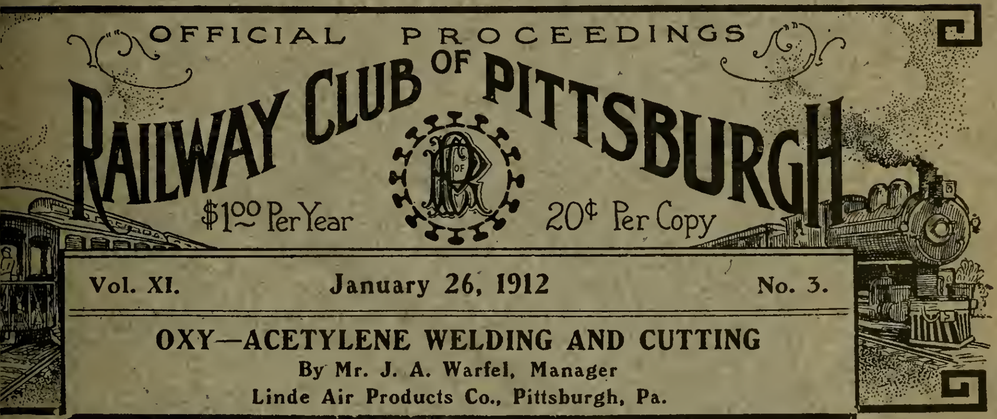

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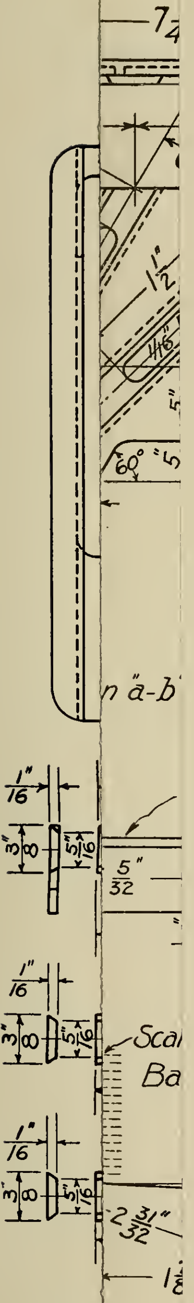

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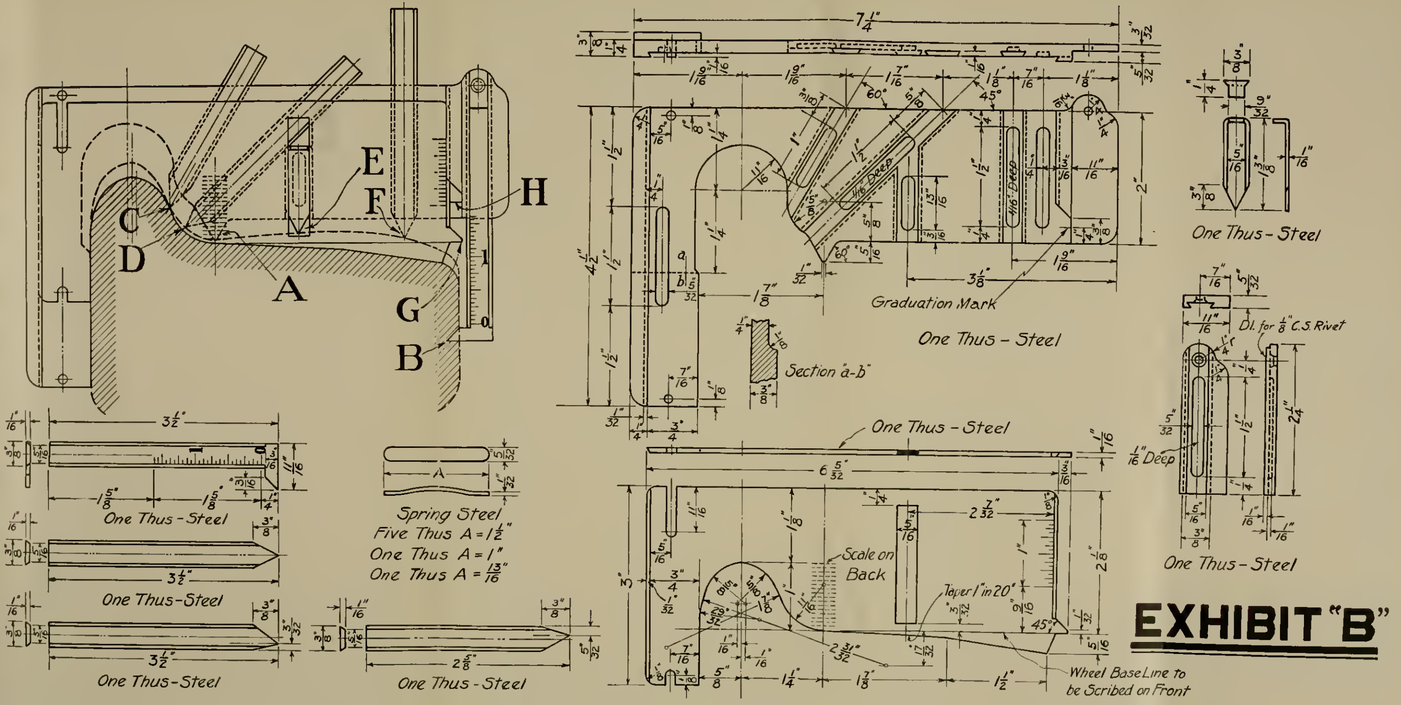

EXHIBIT "B"

This drawing should be inserted between pages 130 and 131 of the March issue of the Official Proceedings of the Railway Club of Pittsburgh.

*No. 3

What the Actual User Says About the Steel Boiler Tube

¶ The Fifth Annual Convention MASTER BOILER MAKERS' ASSOCIATION was held at the Rome Hotel, Omaha, Nebr., May 23, 24, 25, 26, 1911.

¶ The Committee previously appointed reported on the subject of **"Steel vs. Iron Flue. What Advantage and What Success in Welding Them and the Effect of Tube and Maintenance."**

¶ Considerable interesting discussion ensued.

¶ For instance: The Foreman Boiler Maker of a large railroad in the middle West reported as follows: (THE BOILER MAKER, June, 1911, page 167).

> **"We have been using steel safe ends and flues for the last five years, and before that we used iron. We find that the steel gives the best service. The steel flue is here to stay, and I think the iron flue is a thing of the past. In bad water districts you can hardly handle the iron flues."**

¶ You will note the above testimony is quite emphatic, and it is further to be noted, that it is testimony based on actual experience.

¶ The Steel Boiler Tube represents a triple economy as follows:
(1) Saving in first cost.
(2) Saving in maintenance expense.
(3) Greater Mileage—less cost per mile.

¶ We manufacture two types of Steel Boiler Tubes:
(a) Spellerized Lap-Welded Tubes.
(b) Shelby Seamless Tubes.
Each type has peculiar advantages under specific conditions.

¶ The use of the steel boiler tube has netted a considerable saving in actual cash to many present users.

¶ We can save you also a considerable amount.

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*This is the third of a series of announcements containing an opinion of an actual user of the Steel Boiler Tube.

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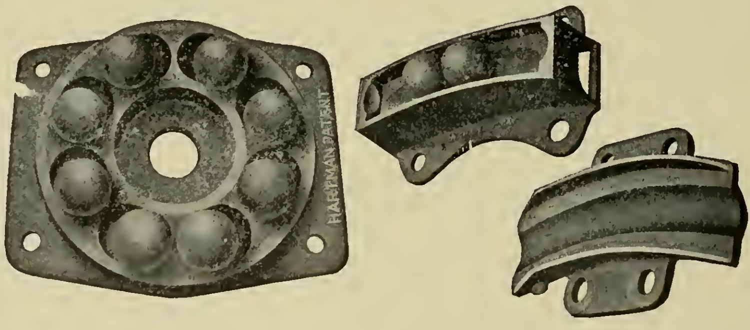

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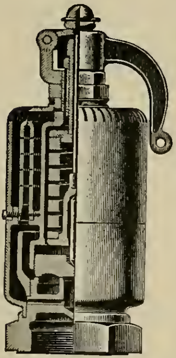

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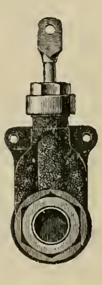

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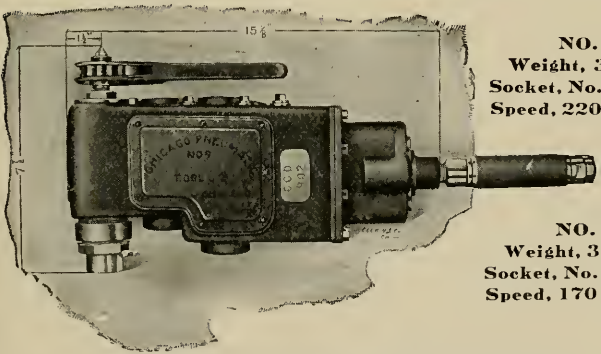

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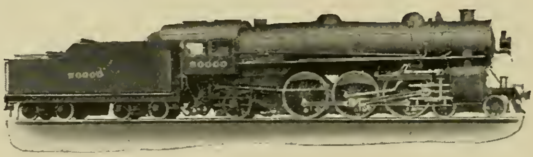

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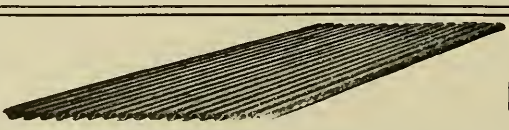

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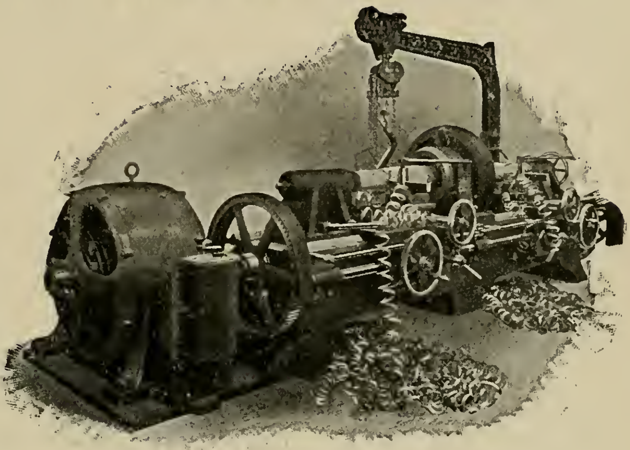

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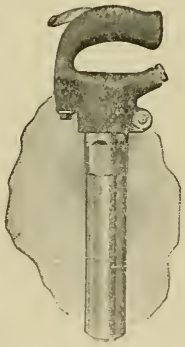

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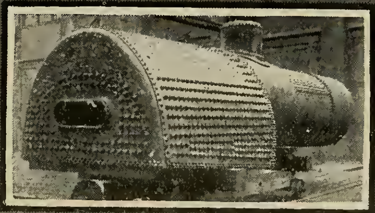

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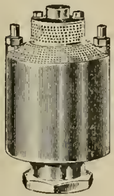

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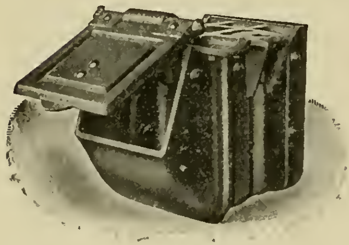

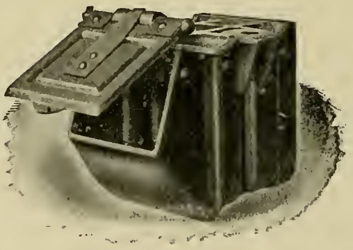

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ORGANIZED OCTOBER 18, 1901.

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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING, JANUARY 26th, 1912.

The meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., with President F. R. McFeatters in the chair.

The following gentlemen registered:

MEMBERS.

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Fettinger, H. O.
Fitzgerald, D. W.
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Peach, W. M.
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Pfeil, John
Pfister, A. J.
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Robinson, S. R.
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Rowe, Martin L.
Rupp, R. D.
Schiller, John
Schomberg, W. T.
Schoming, Geo.
Schultz, G. H.

Scott, W. A., Jr.
Shook, S. D.
Shumaker, F. S.
Smith, C. E.
Smith, F. W., Jr.
Smith, J. B.
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Terrell, H. W.
VonNormann, A. R.
White, J. P.

The reading of the minutes of the last meeting was dispensed with, they having already been published.

The Secretary read the following list of applicants for membership:

Anderson, D. M., Manager Railway Steel Spring Co., Twentieth and Liberty Sts., Pittsburgh. Proposed by Henry F. Gilg.

Anderson, J. P., Chief Draughtsman, Pressed Steel Car Co., 5257 Carnegie Ave., Pittsburgh, Pa. Proposed by M. C. Blest.

Adams, Lewis, Clerk, Pressed Steel Car Co., 4004 Westminster St., Pittsburgh, N. S., Pa. Proposed by C. W. Millar.

Basler, F. M., Assistant Scale Inspector, P. R. R. Co., 809 Fifth Ave., Altoona, Pa. Proposed by F. C. Taylor.

Bauer, A. C., Foreman Erecting Shop, P. R. R. Co., 228 North Rebecca St., Pittsburgh. Proposed by H. W. Rinehart.

Bender, Frederic H., Draughtsman, Pressed Steel Car Co., 421 Sheffield St., Pittsburgh. Proposed by Harry Howe.

Billingham, R. A., Superintendent Motive Power, P. S. & N. R. R., St. Marys, Pa. Proposed by Geo. A. Gallinger.

Burford, W. F., Extra Agent, P. R. R. Co., Box 463, Freeport, Pa. Proposed by W. P. Peters.

Clark, D. G., Local Sales Manager, Firth-Sterling Steel Co., 1422 Oliver Bldg., Pittsburgh, Pa. Proposed by F. M. McNulty.

Cryle, William, Special Officer, P. R. R. Co., Freeport, Pa. Proposed by W. P. Peters.

Daily, Irwin P., Clerk, Station Master's Office, B. & O. R. R., 768 Melbourne St., Pittsburgh, Pa. Proposed by W. C. Drake.

Deane, Robert, Chief Clerk to General Yard Master, B. & O. R. R., 4631 Chatsworth Ave., Pittsburgh, Pa. Proposed by W. C. Drake.

DeWitt, Jennings, Vice President, Freeport Clay Products and Mineral Co., Freeport, Pa. Proposed by W. P. Peters.

Dunne, Walter L., Rep.. National Linseed Co., 203 Oliver Bldg., Pittsburgh, Pa. Proposed by H. A. Pratt.

Easter, Dr. D. M., Medical Examiner, P. R. R. Co., Youngwood, Pa. Proposed by J. H. Gumbes.

Hager, C. S., Assistant Supervisor, P. R. R. Co., Box 494, Freeport, Pa. Proposed by W. P. Peters.

Henry, Frank P., Assistant Mill Foreman, Schoen Steel Wheel Wks., 80 McKinney Ave., Norwood Place, McKees Rocks, Pa. Proposed by D. W. O'Leary.

Hyde, Elbert L., Patent Attorney, 1344 Oliver Bldg., Pittsburgh, Pa. Proposed by Frederick Winter.

Klein, Nicholas P., Assistant Foreman Car Repairs, P. R. R. Co. Shops, South Pittsburgh. Proposed by Jacob Jenney.

Kopferschmidt, B., Foreman Tin Shop, P. R. R. Co., 2444 Wylie Ave., Pittsburgh, Pa. Proposed by W. H. Sullivan.

Lewis, David P., Foreman, Machine Shop, Schoen Steel Wheel Wks., 714 Island Ave., McKees Rocks, Pa. Proposed by F. W. Waddell.

McCartney, J. G., General Foreman, Passenger Department, Pressed Steel Car Co., 411 Russelwood Ave., McKees Rocks, Pa. Proposed by J. M. Ranck, Sr.

McCurdy, G. E., Engineer, Penna. Lines West, 1113 Union Station, Pittsburgh, Pa. Proposed by R. S. Frame, Jr.

McDonough, P. J., Chief Clerk to Master Mechanic, Schoen Steel Wheel Wks., 3270 Bailey Ave., Pittsburgh, N. S. Proposed by F. W. Waddell.

Porter, C. D., Assistant General Foreman, P. R. R. Co., Pitcairn, Pa. Proposed by J. F. Courson.

Richards, H. L., Tariff Inspector, P. R. R. Co., 222 Union Station, Pittsburgh, Pa. Proposed by W. P. Peters.

Rumsey, T. O., Jr., Foreman, Wheel Department, Schoen Steel Wheel Wks., 708 Vance Ave., Coraopolis, Pa. Proposed by F. W. Waddell.

Sewell, H. B., Rep., H. W. Johns-Manville Co., 951 Liberty Ave., Pittsburgh, Pa. Proposed by J. B. Anderson.

Shallenberger, C. M., Assistant on Engineer Corps, P. C. C. & St. L. Ry., 5722 Kentucky Ave., Pittsburgh, Pa. Proposed by R. S. Frame, Jr.

Stillwagon, C. E., Chief Clerk to Supt. M. P., P. S. & N. R. R., St. Marys, Pa. Proposed by Geo. A. Gallinger.

Wolfe, John N., Auditor, American Spiral Spring & Manf'g. Co., 506 Collins Ave., Pittsburgh, Pa. Proposed by Henry F. Gilg.

PRESIDENT: As soon as these names have been favorably passed upon by the Executive Committee, the gentlemen will become members.

There are two vacancies on our Standing Committee on Revision of M. C. B. Rules. To the vacancy arising from the death of Mr. Julius Krause, I will appoint Mr. C. E. Boyer, General Car Inspector, P. R. R.; and in the place of Mr. A. Lamar, who has moved from this district, I will appoint Mr. O. J. Parks, General Car Inspector, P. F. W. & C. Ry.

If there is no further business to be taken up at this time, we will proceed with the paper of the evening, on "Oxy-acetylene Welding and Cutting," by Mr. J. A. Warfel, Manager, Linde Air Products Company, of Pittsburgh, Pa.

OXY-ACETYLENE WELDING AND CUTTING.

BY MR. J. A. WARFEL.

Every advance in the art of making metals means ultimately an advance in civilization. In past ages every advance was used in the making of more destructive engines of war with which to enslave other nations, and hence, in most cases, caused a temporary backward step. Today, each new method marks an important step in the arts of peace, and becomes an immediate factor in the civilization of the world. Just such a factor is oxy-acetylene welding and cutting. While this object has been attained to some extent by the use of oxy-gas and oxy-hydrogen, it is only within the last few years that a really satisfactory method has been developed for welding and cutting with the use of oxygen and acetylene gases by means of a blowpipe, simply because we are able to get a very high temperature, full control, and simple application, which are necessary for efficiency.

The highest temperature of the best solid fuel furnaces is about 3000° Fahrenheit. The oxy-hydrogen, which was the hottest of gas flames, is something less than 4000° Fahrenheit. The oxy-acetylene flame gives a temperature of about 6300° Fahrenheit, being more than double the hottest solid fuel heat known.

In every process of welding, internal strains are always set up. These are due to the fact that metal expands when heated and contracts when cooled, so that when two pieces of metal are welded together locally, either by simple fusion of the parts, or with the addtion of molten metal, contraction occurs as the metal cools. When these parts form restrained members of any structure, the internal strains produced are often sufficient to crack the metal.

This is more especially the case when welding is employed on hard, brittle or inelastic material, such as cast iron, and the tendency to fracture is greatly increased if the cooling of the metal after welding is conducted rapidly or irregularly. The magnitude of the forces which brings about this fracture in cast iron may be estimated by the rules for contraction, which hold good in foundry practice, because in simple fusion-welding, the physical conditions of expansion and contraction in and around the weld, are similar to those of the foundry.

Whenever local strains exceed the strength of the metal, a fracture must invariably occur. These strains, however, often remain latent within the metal, so that the fracture may not actually take place until brought about by some external cause, such as a light blow, or even a current of cold air. The less brittle a metal naturally is, or in other words, the more ductile it is, the better it is capable of withstanding internal strains of this description. The sudden cooling of any metallic body which has been welded should be avoided.

In order to relieve a welded piece of metal from internal strains due to welding, it is desirable not only to pre-heat the whole of the part when possible, but also to re-heat it after welding, to a cherry red heat. This causes molecular rearrangement to take place within the metal, which will bring about a distribution, if not an actual dispersion, of internal strains. In the case of cast iron this treatment is imperative where a repair is effected in a restrained member of the structure and not only should preheating and re-heating (or annealing) be always employed, but the raising and lowering of the temperature in so doing should be slow, and the casting should be kept entirely free from air draughts, or other extraneous cooling effects. This treatment is less essential for steel, but it is always beneficial.

Unfortunately for large work, it is generally impossible to anneal the whole structure in this way. In such cases it is a useful makeshift to heat the plate for a considerable area around the weld, both before and after welding. It is clear that the nearer the temperature of the whole structure can be brought to the fusion temperature required for local repair, the less will be the excess of expansion at the welded point, and consequently the less will be the local strain set up at this point when the structure cools. Too much attention cannot be paid to this physical aspect of welding, and even when the process of fusion-welding is employed to fill up flaws in castings, it is desirable, when possible, to heat the whole structure before and after treatment.

The strength of the weld produced by the flame is almost invariably somewhat less than that of the original material. This may be due to the use of welding strips of inferior tensile strength or to those internal strains which have already been referred to. It is also undeniable that the structure of the material in the weld is less homogeneous than in other parts. This, however, is largely a matter of skill on the part of the individual welder. It is possible for a competent welder, at his discretion, to give a greater or less strength to the welded part, and for this reason it is the work of one man again another.

Very often the question is raised as to whether or not iron and steel plate, when welded by the oxy-acetylene process, does not show in the weld a certain quantity of carbon formation, thereby rendering the material at the point of juncture somewhat brittle, and thus having a deteriorating effect upon the weld.

To determine this point, one of our friends had a number of samples taken and plane sections were produced by cutting vertically through the weld. The samples were then ground and polished in the ordinary manner. One part of which had been etched and treated to an alcoholic solution of pictric and showed, according to microscopic photographs taken, that the distribution of the ferrite and pearlite was perfectly regular and even throughout the entire welded portion.

It was thereby shown that the question sometimes raised concerning the impracticability of obtaining a perfect and lasting weld by employing the oxy-acetylene flame, is without scientific or practical foundation, due to the fact that the separation of the carbon claimed to take place by imperfect combustion of the gases, does not exist. The only noticeable irregularity, as the result of the research made, was the fact that the particles of the slag contained in the iron had lost their thread-like character, which is produced in the rolling of the original plate. These showed in the weld as minute knot-like particles, which were distinguished from the pearlite by the color.

Another point often raised, which the experiment seemed to clear up, was the effect of the gases employed in conducting a weld upon the sulphur content of the part welded. It was found that the weld was poorer in sulphur than the product itself, although the distribution of the sulphur in the welded part seemed to be more uniform than it was in the original plate.

When overheating or burning has caused the metal to crystallize through to both sides of the weld, the fibrous structure of the metal may be so far destroyed, and the strength of the weld so impaired, as to make the weld worthless, and even annealing may fail to return the metal to its original condition.

Every man connected with the mechanical department of a railroad or manufacturing industry has his own problems to solve, and if not careful is liable to turn down a proposition which, if given proper attention, proves to be a great time and money-saver for his shop. Just as an example: Some time ago a large factory purchased four automatic machines for a certain class of work. The machines required the services of one good machine hand and one ordinary helper. The machine man, in time, was able to get excellent results, but soon conceived the very bright idea that he should get a substantial increase in pay. The outcome was that they let him go. The succeeding two men put on the machines were failures, principally on account of their not having the services of the man sent out by the company who sold the machines. For two years these machines were idle, and one day a new man came into the department where the machines were standing, and asked permission to have an operator come from the firm who sold the machines and give instructions regarding their operation. The operator sent by the company asked that, in conjunction with a good machine hand, the assistant foreman of the department should learn to operate the machines. Today you will find these four machines giving good service with twelve others which were purchased later.

Another concern, at one time, purchased the right to build certain machines for making some of their products. The principal of the machines was good, but in practice did not work out as expected, consequently the firm buying the right to make them, spent probably a year and a half in re-designing, with the result that they were able to get very good results, and if you should have the opportunity to see the old and the new machines side by side, you would hardly recognize them as being used for the same purpose.

These illustrations were given to show that any apparatus or process which has been carefully worked out and backed by a representative firm, will, if given proper attention, become a success.

Oxy-acetylene welding is a good thing, and to be made successful must be regarded as a trade, which can only be mastered by intelligent work and gradual development from simple to difficult jobs (and truly cannot be mastered within a few days, as we were sometimes led to believe by some over-zealous salesmen). Much depends on the intelligence and ability of the workman. A skilled welder will use a hammer freely as well as a blowpipe, more especially on a vertical or overhead weld in plates which are subsequently to be subjected to pressure strains. By the judicious use of hammering at the right moment on the welded part, the metal can always be made denser, with the result that the strength of the weld is increased.

The following suggestions are practical and necessary for success in welding:

Great care must be taken to remove scale and entirely clean the surface and edge of the metal where the welding is to be done. You must be careful to prepare the parts to be welded either by beveling deeply so as to enable the metal to be melted throughout the entire thickness of the plate or by cutting away sufficient metal to enable the blowpipe flame to penetrate to the under side of the plate, and thus insure that the added metal is welded-in throughout.

In the thicker sections of plate the edges should be melted inwards for at least 25 per cent of the thickness of the plate, while adding additional molten metal from the feeding wire. This is a secret of good welding which beginners invariably neglect.

When working upon sections of material, the experienced welder displays his skill by raising the flame just at the moment when fusion has proceeded so far that complete welding is assured, and before the heat has advanced to a point where the material may be destroyed or pierced. Practice enables him to conduct this operation with great rapidity. It is especially important in thin work that the flame of the blowpipe should not be oxidizing, but rather decidedly reducing.

Light hammering in the case of wrought iron and steel is, when possible, always desirable, while the metal is in a plastic condition.

Never attempt to re-weld a cracked weld. Always cut or drill out a larger area than before, in order to remove all filling-in material, then re-weld, and insert a patch if required.

Never neglect to pre-heat and afterwards anneal as much as possible. The importance of this treatment cannot be exaggerated, not only in dealing with cast iron, but in materials of all description.

In the welding of ordinary iron, or mild steel plates, it is found that the best general results are obtained by employing as the welder-feeder, soft Norway or Swedish iron wire, as free as possible from carbon.

In the welding of cast iron rods of ferro-silicon are employed as feeders. Pure metallic copper is also sometimes employed as a feeder in the repair of complicated cracks in cast iron, with which it is found to make a satisfactory weld. As a general rule, it is also found advantageous to employ some welding flux, of which there are several varieties on the market.

Copper to copper fusion welding is frequently employed, but chiefly on light work. Owing to the great heat conductivity of copper, local welding cannot be effected with the same economy as in the case of iron or steel.

Aluminum is very successfully welded today by simply keeping out of the weld the film of aluminum oxide which forms in the weld.

It has been interesting to watch the rapid development of oxy-acetylene welding during the past two years, and the next two years will, without doubt, see a much more rapid development.

STEREOPTICON VIEWS SHOWN AND EXPLAINED.

You, no doubt, are aware that the battleship Maine, in Havana Harbor, is being cut up by the oxy-acetylene blowpipe, and believe you will be interested in some general views of the wreckage.

1—General view of the Maine and cofferdam.

2—The acetylene generator is shown on top of the port turret. The starboard turret, with its two ten-inch guns, have never been found. The armor of the turret was ten inches thick.

3—General view taken while blue jackets from the North Carolina were visiting the wreck.

4—Secretary of War Stinson visiting the wreck.

5—Seven 18-inch I beams cut in less than two hours. (Fig. 1.)

Figure 1.

6—Two 2½"x8¼" and two 4"x11" steel risers cut in 16 minutes.

7—Some cutting done on the S. S. Kentucky at the Norfolk Navy Yards; about 20 feet of cutting through steel structure varying in thickness from ¾" to 3". Total time of cutting, 1 hour and 45 minutes. Cost of cutting, including labor and material, about $4.90.

8—Showing repairs made to lower tube sheet of a Cahall vertical water tube boiler. Thickness of plate ¾" and diameter of tubes 4". The usual method for making repairs to the lower sheet was to tear down the outside wall of brick, take out all the tubes, about 130, and put in an entire new sheet. In making repairs with the oxy-acetylene blowpipe, tubes were removed from the defective holes and repairs were made without disturbing any other part of the boiler. You will note that there were cracks in the flange at holes 2 to 8 inclusive, and 14 and 15, which were chipped out, and in this instance not in the proper manner, as the workmen misunderstood what was meant by a V-shaped opening, and chipped away the metal clean, leaving an opening at the tube hole about 1½" wide and extending in a V shape, down to the bottom of the flange. This opening was chipped straight down without leaving a bevel of any kind, and for this reason you can readily see that the work was much greater than it would have been if the job had been properly prepared. This welding proved beyond a doubt that large openings could be closed up by another kind of metal and successfully stand steam pressure under actual working conditions. In addition to filling the large openings, it was necessary also to weld on new material around the tube holes 1 to 17 inclusive. These holes had all been worn eliptical in shape and in some cases were ⅜″ out of round. At tube 16 a patch had been riveted on, but was leaking badly. This was completely covered over, the rivets were welded in, and the crack, about 2″ long in the tube sheet, was welded from the under side, demonstrating that overhead welding can be successfully carried out. The actual time for welding was 17 hours and the total cost, including labor and material, was $29.40, against $700 to $1,000 to do the work in the usual way. The work was thoroughly inspected by a representative of the Fidelity Insurance Company, who pronounced it O. K., and the boiler, with several others repaired at the same time, has been in operation for almost one year under 160 pounds steam pressure. (Fig. 2.)

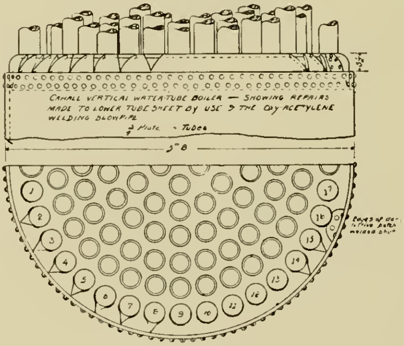
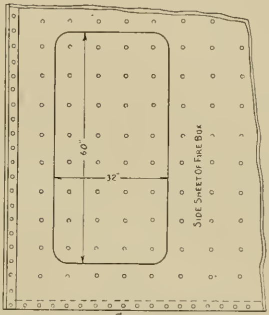

CAHALL VERTICAL WATER-TUBE BOILER — SHOWING REPAIRS MADE TO LOWER TUBE SHEET BY USE OF THE OXY-ACETYLENE WELDING BLOWPIPE
¾ Plate – Tubes
5″ 8
Edges of defective patch welded shut
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Figure 2.

9—Showing method of preparing patches for welding into side sheets. Letter "A" represents the staybolts and "B" represents the bolts. The first operation for putting in a patch of this description is to cut out an opening in the side sheet with the cutting blowpipe, and with a pneumatic chisel bevel the edge and then prepare a sheet to fit the opening, beveling the edge of the sheet, also fluting the sheet all the way around, as shown by the light lines over the staybolts. After the weld is completed, it is possible to hammer out part of the flute in order to make a more level surface.

10—Showing a sheet welded in down to mud ring. On one end the sheet is 28″ wide and on the other it is 40″. The total length is 73½". Time for welding was 13½ hours. Total cost, including labor and material, approximately $17.00.

11—Showing patch welded in side sheet of fire box 32" wide, by 60" long. Time 17 hours with welder and helper. Total cost, including labor and material, $20.50. The time given includes delays in making electric light connection, air hammer connections, welding and for boiler makers to vacate firebox. (Fig. 3.)

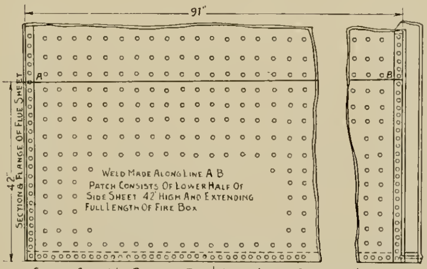


Time 17 Hrs 2 Men Total Cost $20.46

The Time Given Includes Delays in Making Electric Light Connections Air Hammer Connections Waiting For Boiler Makers To Vacate Fire Box And Time Consumed In Preparing The Cracks Etc For Welding It Does Not Include The Time Necessary To Make And Fit Patches

Figure 3.

12—Showing side sheet 42" high extending along full length of firebox 91" which was welded in. The old sheet was cut out with the cutting blowpipe in 15 minutes, one man operating, total cost 60c. The weld was made in seven hours with one welder and a helper. Total cost, including labor and material,


91"
42"
Section & Flange Of Flue Sheet
A
B
Weld Made Along Line A B
Patch Consists Of Lower Half Of Side Sheet 42" High And Extending Full Length Of Fire Box

Cutting Sheet With Blow Pipe - Time ¼ Hrs 1 Man Total Cost $.60
Welding 7 2 Men " " 8 96

The Time Given Includes Delays In Making Electric Light Connections, Air Hammer Connections Waiting For Boiler Makers To Vacate Fire Box, And Time Consumed In Preparing The Cracks, Etc For Welding It Does Not Include The Time Necessary To Make And Fit Patches

Figure 4.

$8.96. The time given includes delays in making light connections, air hammer connection and waiting for boiler maker to vacate firebox. (Fig. 4.)

13—Showing six cracks between staybolts on inside sheet at fire line. Time for doing the work includes eight hours for welder and three hours for boilermaker. Total cost, including labor and material, $8.68. If these cracks had been plugged, 190 plugs would have been required at a total cost of $17.90 for labor and material. Estimated saving of $9.12. (Fig. 5.)

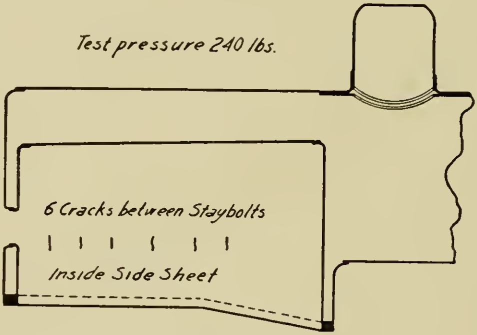


Figure 5.

14—Showing at 8″ crack inside the smoke box. Time for welding, 3½ hours, one man. Total cost, including labor and material, $4.00. (Fig. 6.)

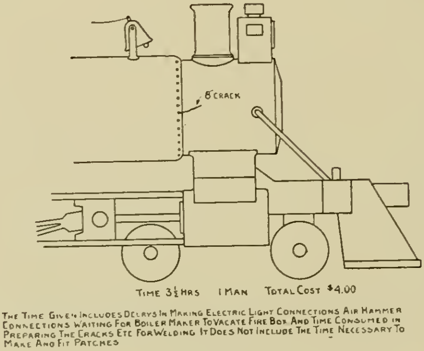

8″ CRACK
TIME 3½ HRS   1 MAN   TOTAL COST $4.00
THE TIME GIVEN INCLUDES DELAYS IN MAKING ELECTRIC LIGHT CONNECTIONS AIR HAMMER CONNECTIONS WAITING FOR BOILER MAKER TO VACATE FIRE BOX AND TIME CONSUMED IN PREPARING THE CRACKS ETC FOR WELDING IT DOES NOT INCLUDE THE TIME NECESSARY TO MAKE AND FIT PATCHES

Figure 6.

15—Upper sketch shows a crack along the bend of the side sheet. Time, two hours, one man. Total cost, including labor and material, $1.54. Lower cut shows patch in corner of front sheet 7″x9″. Time 3½ hours, one man. Total cost, including labor and material, $3.96. (Fig. 7.)

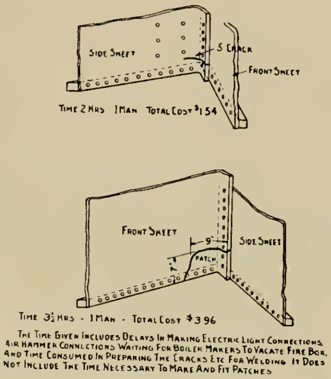

Side Sheet
5 Crack
Front Sheet
Time 2 Hrs 1 Man Total Cost $1 54
Front Sheet
9″
Side Sheet
7″
Patch
Time 3½ Hrs - 1 Man - Total Cost $3 96
The Time Given Includes Delays In Making Electric Light Connections
Air Hammer Connections Waiting For Boiler Makers To Vacate Fire Box,
And Time Consumed In Preparing The Cracks Etc For Welding It Does
Not Include The Time Necessary To Make And Fit Patches

Figure 7.

16—Cracks welded in flange of back flue sheet. Plugs were removed and hole filled, 2½″x½″. Plugs removed from side sheet and hole filled, 4″x½″. One-inch crack in the upper right-hand corner of back flue sheet. Time for three operations, 3 hours. Cost $2.57.

17—Steel plate transformer tank with radial tubes to provide additional radiating surface for cooling of hot oil in transformer. Longitudinal seams of tank are welded and all bent tubes are welded in shell.

18—View showing shape of open joint in a cylindrical shell when being welded. The open sides draw together as welding proceeds and it is necessary to keep the two edges apart about ¼″ to the foot.

19—An ammonia generator with the vertical analizer shell welded directly onto the horizontal generator shell. Both shells are 24″ diameter inside, made of ½″ flange steel. The vertical shell is about 6 ft. long and the horizontal about 11 ft. long. Tested and found tight at 400 lbs. pressure per sq. in. hydr. pressure. (Fig. 8.)

20—Steel ammonia receiver, 10″ diameter by 4 ft. long with

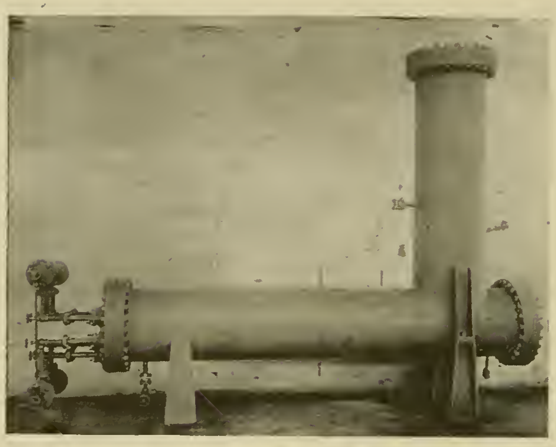


Figure 8.

welded heads. Tested up to 2500 lbs. per sq. in. hydr. pressure. No leak.

21—Steel pipe headers with welded nozzles for ammonia connections. Tested with 300 lbs. air pressure under water.

22—Ammonia accumulator 36″ in diameter by 10 ft. long. Shell ⅜″, heads ⅝″ welded. Two 10″ dia. pipe nipples welded on top head. 3″ side nozzles welded to shell and lower head. Tested to 400 lbs. hydr. pressure.

23—Welding a girth seam on a shell. Shell 49″ in diameter by 36 ft. long, ⅝″ thick steel.

24—Same shell just shown, showing the longitudinal as well as the girth seam.

25—This is the shell shown in the previous slides, which, completed, is used as an ammonia generator under a working pressure of 300 lbs.

MR. WARFEL: I have some liquid air here which I thought might be of interest to you.

QUESTION: How far is the liquid air below zero?

MR. WARFEL: 312° F.

QUESTION: How long will it stay liquified?

MR. WARFEL: We sent a receptacle like this from Buffalo to New Orleans.

PRESIDENT: I understand there are quite a number here who have had experience in handling the oxy-acetylene blowpipe on wreck trains and in shops, and we would be glad to hear from any of them. Mr. Davis, will you give us some of your experience?

MR. I. J. DAVIS. I have had some experience in the use of the oxy-acetylene welding system. And there is one question I would like to ask while we are on the subject, and that is with reference to the space required to make a perfect weld between two adjoining members before making a weld, in other words, how close the metal should come before you commence to fill in.

MR. WARFEL: Simply bevel the metal to a point on each side and bring them together.

MR. DAVIS: It is not always economical to bevel the material before you weld it.

MR. WARFEL: What thickness of material?

MR. DAVIS: Take the use of 3/32″, ⅛″ or 3/16″ metal.

MR. WARFEL: You get better results by beveling 3/32″ and upwards.

MR. DAVIS: From what we have found out from practical experience we have been leaving the metal apart possibly the thickness of the metal.

MR. WARFEL: That will work out all right, but the expense increases as you increase the distance between the parts to be welded.

MR. DAVIS: What practice would you follow to prevent light sheets from buckling, caused by the heat which you carry throughout the sheet, due to the welding process?

MR. WARFEL: If you have in mind the sides of cars, you do not want any projection, you want it perfectly straight. The only thing to do is to put the sheets in a jig, to hold them down to position.

MR. F. W. WINTER: There is one question I would like to ask. In welding side sheets of fire boxes of locomotives, how is the pre-heating effected? When you showed cracks in the locomotive smoke box in your pictures, what preparation is made, is any of the material cut out, and if so, how much? Then in the welding of aluminum, what is the best method of removing the film of oxide which forms on the wall?

MR. WARFEL: In preparing a crack such as shown in the smoke box, simply bevel to the bottom of the sheets.

MR. WINTER: Mechanically or with the blowpipe?

MR. WARFEL: With a chisel.

MR. WINTER: The pre-heating of the side sheets of the firebox, how is that accomplished?

MR. WARFEL: It is not necessary to pre-heat on side sheets, but it is a good plan to re-heat around the weld a short distance after finishing the weld.

MR. DAVIS: You say to bevel the metal before you proceed to weld. What direction would you bevel that metal, in or out? For instance, where you have two sheets lying one on top of the other with a butt joint and you want to weld that joint, what is the best method of beveling that, in or out?

MR. WARFEL: Bevel it out about 45°. All that is for is to enable you to get to the bottom of your sheet.

MR. A. STUCKI: There is too much harmony here to suit me. First of all, as to the welding, I have really nothing to add. We all agree that it is a first-class means of uniting metal. Look at that crack in the smoke box. How cheaply and quickly it was done, and in my opinion it is just as good as the solid sheet. And for sides of a car or for these small gas tanks I feel perfectly satisfied that it makes a job as good as the original. Also a corner of a firebox, possibly. But to weld up a boiler sheet or a boiler head with Norway iron and think we have as good a job as the original, I can not see it yet. When you design a boiler you figure on all the stresses and all the strength there is in the steel originally, to give you a factor of safety. Now steel is very much stronger than Norway iron. And even assuming that you have a job as good as you can possibly make it, you certainly haven't got a job any stronger than the Norway iron, which is very much weaker than steel originally, not to speak about the excessive heating that has been mentioned. This is one point on which I am in doubt, and, for my part, I would not like to run a locomotive with a boiler treated that way.

To come to the question of cutting, that is another very important field, just as important as the welding. There is absolutely no question about the speed. You can cut metal just as quickly and as nicely as you want to. And Mr. Warfel was kind enough to show me to my satisfaction that the cutting of thin sheets can be done successfully and economically. And as a result, the company with which I am connected purchased an apparatus and it is doing good work, especially in welding. There is no question that it paid for itself long ago. But as to cutting thick heads of casting, I do not speak of the speed—that is all right—but as to the cost, I am not satisfied at all as to whether it is cheaper than to use a cold saw. I would like the speaker to give us exact figures in each case. Say we have a piece 7″ in diameter. We know what it costs with cold sawing. What should it cost with your process? If it costs us more than that I would like to know why we do not get the same results. You told me once we did not have our nozzles adjusted right. I would be glad to get exact information on the cost question, what it should cost.

MR. WARFEL: There is one man in the audience who does not want to talk, but I would just like him to tell us whether he thinks the plant in his foundry cuts them off as cheaply. That is Mr. Way.

MR. L. A. WAY: We have installed in the steel foundry a machine for cutting off the heads of steel castings. Doubtless Mr. Warfel is familiar with it. We had in our foundry four high-speed inserted teeth saws. It took two men on day turn and two men on night turn to keep up with our work with these four saws. Now, with one cutter working nine hours a day, with one man, I am always right up to the limit. I have figured it out on many castings and it is a fact that it is cheaper in every way. And they will cut off a head of a steel casting while a man is setting it up and getting it ready for a cold saw.

MR. STUCKI: How much oxygen is used in that test?

MR. WAY: We use anywhere from six to ten tanks a day with an average of six tanks a day during the month. We have two plants, one at each end of the foundry, and one man will often get ahead in his work and go down to the other end with the other man, and that makes the use of oxygen run up. He would probably use three tanks at his end and go down to the other end of the work, so that some days we will use ten tanks, some days five, some days four, but they keep the work up with an average of about six tanks a day.

MR. WARFEL: Using an average of six tanks of oxygen per day, with the man and the acetylene would probably run $16.00. Of course, this cutting is largely up to the skill of the operator. One man will use double the amount another will use on account of using a greater pressure.

MR. FELIX KOCH: What proportion would you use between acetylene and oxygen in welding, and what is the effect on the weld of using more oxygen than acetylene?

MR. WARFEL: Too much oxygen will oxidize the weld.

MR. KOCH: What is the proper proportion?

MR. WARFEL: About 1.5 cu. feet of oxygen are consumed for one cubic foot of acetylene.

PRESIDENT: I understand there are men here who understand or have had experience in wrecking, cutting draw bars, and that kind of thing. Mr. Halliwell, Assistant Master Mechanic, P. R. R.?

MR. C. J. HALLIWELL: I do not know that I can say a whole lot on the subject. Practically all the work is being done in our department by this process it works all right and assists materially in clearing up accidents. While I am on the subject, I would like to ask about welding tubes. That is a question we are very much interested in, and are having trouble with.

MR. WARFEL: Welding tubes into the back flue sheet of a locomotive has been tried by two railroad companies without success. At the present time, one of these companies is experimenting along the lines of brazing. How far that has gone I am unable to say. I do not think they have made any report on it. It is something we have not done so far.

MR. B. KOPFERSCHMIDT: Is it impossible?

MR. WARFEL: They claim that they do it in France. We have not done it in this country, so far as I know.

PRESIDENT: Mr. Kopferschmidt, can you give any information on the brazing of flues?

MR. KOPFERSCHMIDT: I would not expect to braze them—I would try to weld them. In brazing a flue, we could not control expansion and contraction, and so the sheet cracked. We had a flue sheet outside of a locomotive on which we tried to braze flues with a Linde torch, which did not crack. I do not know how it was for strength, but I do not belive it would hold the vibrations of the flue. Generally I try welding. Sometimes we get a pretty good job of welding by keeping the sheet warm all of the time. When you weld a flue you must get your expansion out on the side and you have got more metal in the flue sheet. By keeping it warm all of the time, when you get through with a finished flue and drive a drift pin in it, it expands about 1/16", so that it will contract when it is cold and come back into its place again. I have not tried them in a boiler, as yet, but I am convinced that it will work and I would like to get a chance at it.

MR. KOCH: What is the effect on the weld by using too much acetlyene?

MR. WARFEL: You will get a reducing or carbonizing weld.

MR. KOPFERSCHMIDT: Can you cut cast iron?

MR. WARFEL: No; only wrought iron and steel.

DR. J. S. UNGER: I am sure the members of this Club have spent a very pleasant hour. I move you that we tender to Mr. Warfel a hearty vote of thanks for the very interesting lecture he has given us.

The motion of Dr. Unger, being duly seconded, was put to a vote and carried unanimously.

PRESIDENT: Mr. Warfel, please accept the thanks of the Club for your courtesy.

ON MOTION, Adjourned.

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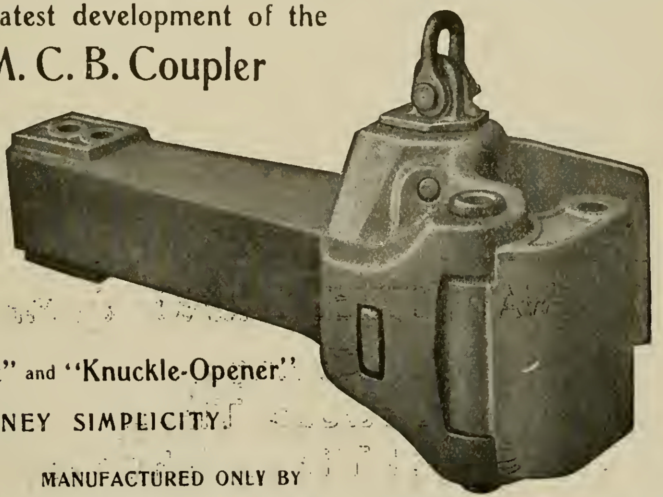

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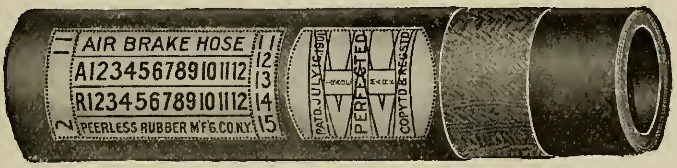

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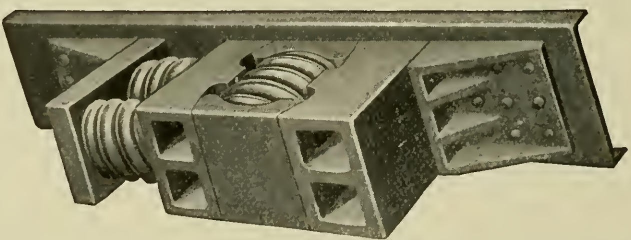

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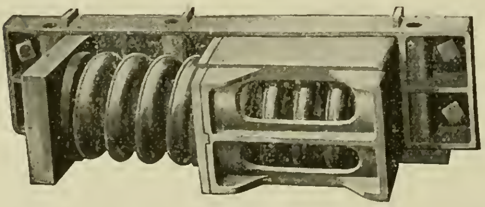

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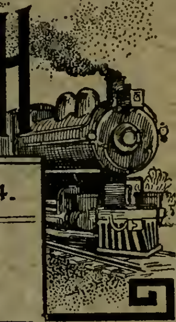

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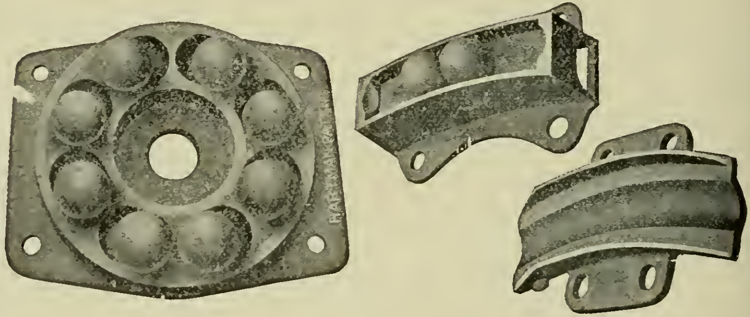

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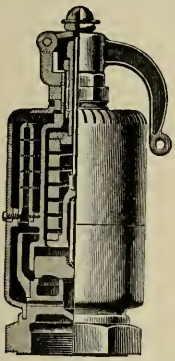

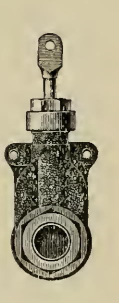

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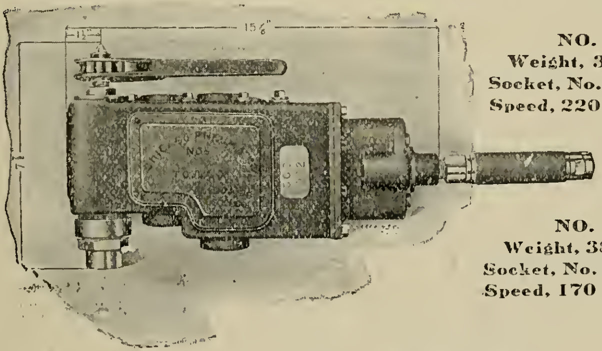

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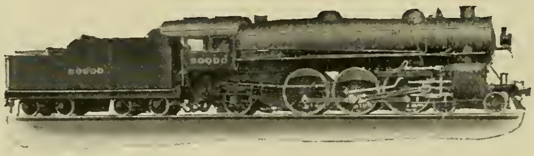

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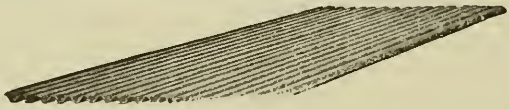

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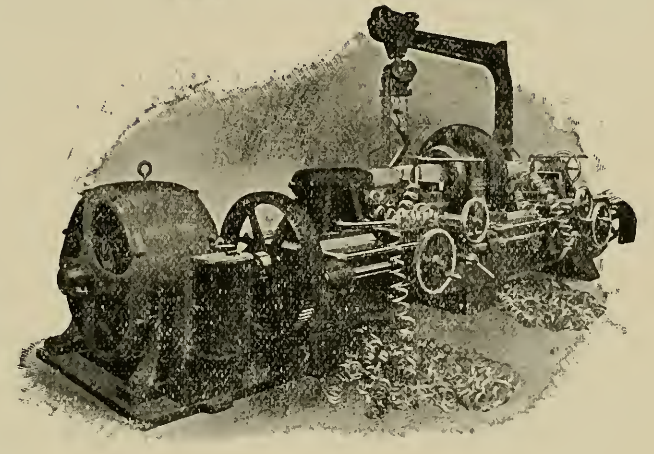

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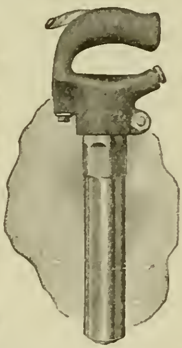

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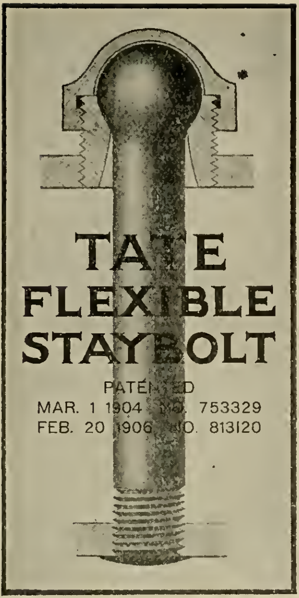

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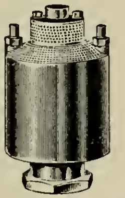

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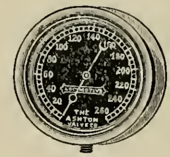

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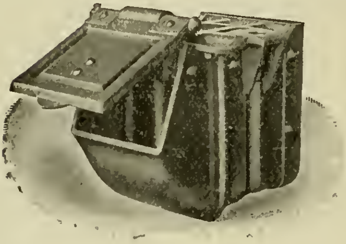

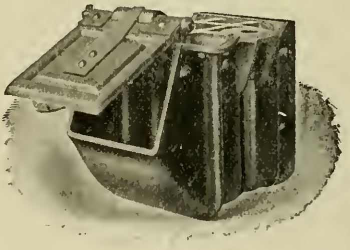

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Vol. XI.
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Pittsburgh, Pa., February 23, 1912.

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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
FEBRUARY 23rd, 1912.

The regular monthly meeting of The Railway Club of Pittsburgh was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., with President F. R. McFeatters in the chair.

The following gentlemen registered:

MEMBERS.

Adams, Lewis
Albree, C. B.
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Cole, Jewett
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Cryle, Wm.
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Deckman, E. J.
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Drane, E. J.
Easter, D. M.
Froelich, J. H.
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Flaherty, P. J.
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Hilty, H. A.
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Howe, Harry
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King, Wm. R.
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Lanning, C. S.
Lanning, J. F.
Lee, L. A.
Lehr, H. W.
Lewis, D. R.
Lockard, J. A.
Lobez, P. L.
Long, R. M.
Mackert, A. A.
Malloy, M. A.
Mason, Stephen C.
Mensch, E. M.
Millar, C. W.
Mitchell, A. G.
McCauley, Wm.
McDermitt, W. W.
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McFeatters, F. R.
McIlwain, J. D.
McKeen, J. W.
McNaight, A. H.
Orner, M. T. S.

O'Connor, M.
O'Leary, D. W.
Parkinson, H. D.
Perry, W. E.
Pfeil, John
Porter, H. V.
Postlethwaite, C. E.
Proven, John
Publow, John J.
Ranck, J. M., Sr.
Raser, Geo. B.
Redding, D. J.
Reid, D. K.
Richardson, S. W.
Rivinius, Carl
Rohn, W. B.
Rowe, M. L.
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Wilson, Chas. T.
Wilson, R. C.
Wonn, H. M.

The reading of the minutes was dispensed with, they being in the hands of the printer.

The Secretary read the following applications for membership:

Ashworth, Wm., Salesman, Johnston, Morehouse, Dickey Co., 106 Market St., Pittsburgh, Pa. Proposed by S. D. Shook.

Barker, B. F., Weighmaster, B. R. & P. Ry., 132 South Brady St., DuBois, Pa. Proposed by Wm. J. Knox.

Cook, Thos. R., Assistant Engineer M. P., Lines West, 1002 Union Station, Pittsburgh, Pa. Proposed by J. B. Anderson.

Danforth, G. H., Assistant Structural Engineer, Jones & Laughlin Steel Co., Third Ave. and Ross St., Pittsburgh, Pa. Proposed by D. M. Howe.

Dudley, S. W., Assistant Chief Engineer, W. A. B. Co., Wilmerding, Pa. Proposed by R. I. Cunningham.

Green, Thomas C., Salesman, Garlock Packing Co., 408 Mirton St., Pittsburgh, Pa. Proposed by S. D. Shook.

James, J. M., Superintendent Motive Power, Penna. R. R., 207 Union Station, Pittsburgh, Pa. Proposed by J. B. Anderson.

Moon, E. D., Assistant Train Master, B. & O. R. R., Callery, Pa. Proposed by J. J. Publow.

Morrison, R. J., Draughtsman, Penna. R. R., 7016 Upland St., Pittsburgh, E. E., Pa. Proposed by Theo. L. Shourek.

McKeon, R. D., Assistant on Engineer Corps, P. C. C. & St. L. Ry., 3111 Landis St., Sheridan, Pa. Proposed by R. S. Frame, Jr.

O'Brien, T. C., Motive Power Inspector, B. & O. R. R., 1008 House Bldg., Pittsburgh, Pa. Proposed by M. O'Connor.

Palmer, J. G., Foreman Tool Room, Erie Ry., 2988 E. Sixty-first St., Cleveland, O. Proposed by M. O'Connor.

Parke, F. H., Resident Engineer, W. A. B. Co., 318 Westinghouse Bldg., Pittsburgh, Pa. Proposed by R. I. Cunningham.

Parks, O. J., General Car Inspector, Lines West, Fort Wayne, Ind. Proposed by R. L. Kleine.

Pierce, Harry B., Train Master, Monongahela R. R., Brownsville, Pa. Proposed by F. R. McFeatters.

Reymer, C. H., Manager Order Dept., Oliver Iron & Steel Co., So. Tenth and Muriel Sts., Pittsburgh, Pa. Proposed by F. M. McNulty.

Rice, R. S., Draughtsman, P. R. R., 6841 Frankstown Ave., Pittsburgh, Pa. Proposed by Theo. L. Shourek.

Shook, A. A., Superintendent Power, Jones & Laughlin Steel Co., Twenty-seventh and Carson Sts., Pittsburgh, S. S., Pa. Proposed by F. M. McNulty.

Sullivan, D. W., Telephone Inspector, P. R. R., 304 Union Station, Pittsburgh, Pa. Proposed by Theo. L. Shourek.

Wyke, J. W., Traveling Engineer, Union R. R., 2223 Manor Ave., Swissvale, Pa. Proposed by A. F. Coulter.

PRESIDENT: As soon as these applications have been favorably acted upon by the Executive Committee, the gentlemen will become members.

The Secretary announced the death of the following members of the Club: Mr. Wallace W. Johnson, General Manager, Standard Magnesia Co., Philadelphia, Pa., and Mr. W. W. Young, Purchasing Agent, Union Switch & Signal Co., Swissvale, Pa.

PRESIDENT: Instead of appointing committees to draft suitable memorial resolutions upon the decease of members, it has been decided to havē the Secretary write the family of the deceased member, and set aside a memorial page in the Proceedings. I will, therefore, not appoint committees on memorial resolutions at this time, or in the future.

If there is no further business to come before the meeting, we will proceed with the paper of the evening. I take pleasure in presenting to you Mr. G. K. Heyer, Railway Sales Engineer, Western Electric Company, New York, who will present a paper upon the subject, "The Use of the Telephone in Railroad Service."

MR. G. K. HEYER: I am very glad to have this opportunity of talking to the members of the Railway Club of Pittsburgh.

THE USE OF THE TELEPHONE IN RAILROAD SERVICE

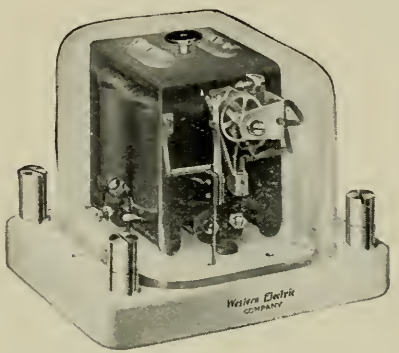
For the past four years a great deal of attention has been given by the progressive railroads to the improved method of handling train movements known as telephone train dispatching. There are, at the present time, approximately 285,000 miles of railroads in the United States and Canada, and the 55,000 miles of road which has been equipped for this new method of handling traffic stands as a monument to the success of the undertaking.

It is thought that a brief outline of the history of train dispatching would be interesting before going further into the subject.

Previous to the time of the introduction of the telegraph, trains were run on what was called the "time interval" system. With this system the ruling train had the right of one hour against an opposing train of the same class. Under this method of operation a great deal of time was lost if trains were late, and it was through the foresight of Superintendent Charles Minot, of the Erie Railroad, that the telegraph, in 1850, made possible the abolition of the old "time interval" and "flag" system of advancing trains and the adoption of the telegraph dispatching system, which it was thought, for many years, possessed sufficient advantages to allow other branches of railroads to be developed to the greatest possible efficiency.

In recognition of the marked advance made by the use of the telegraph in 1850, the National Association of Railway Superintendents of Telegraph are having erected at Turners, New York, a monument to the memory of Charles Minot, who gave the first telegraphic train order from that point. It is expected that this monument will be completed and unveiled in May of this year.

After the telegraph was first used by the Erie, there was begun, in 1851, a systematic attempt to telegraph orders from a central point to trainmen and conductors, and from that time up to the latter part of 1907 all train movements were directed by the telegraph.

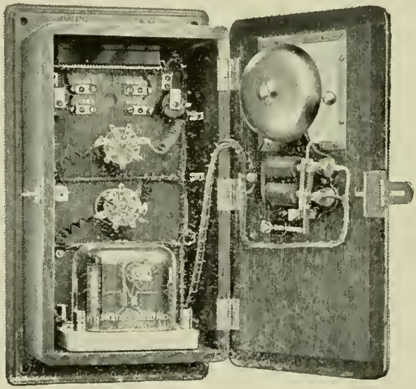


Western Electric Selector.

While October, 1907, marks the first successful installation of telephone and selector equipment for train dispatching, there were previous to that time a number of roads which used the telephone equipment for handling train movements. As early as 1883 the New Orleans and Northeastern Railroad used the telephone for this purpose. The service was rendered over a grounded iron wire about 100 miles long, with the ordinary magneto telephone, as used at that time, and without the aid of the selector, which mechanism has made possible selective calling on long and heavily loaded railway telephone lines.

The telephone equipment used on all of these installations was far inferior to that in service at the present time, and the great improvements which have been made in the last two or three years in the telephone and selective apparatus, together with the new apparatus designed to meet the special requirements of the service, indicate that there are few, if any, requirements for communication to meet the conditions of railway service which cannot be met by the use of the telephone.

The New York Central was the first to install and actually operate trains by means of the telephone and selector equipment. Their first installation was completed in October, 1907, on a section of the main line between Albany and Fonda, with 16 way-stations. The installation on the New York Central was closely followed by a number of installations on the Chicago, Burlington & Quincy, where in December, 1907, the main line between Aurora and Mendota, Illinois—a distance of 46 miles, with 11 stations—was equipped. After this, a section from Aurora to Galesburg, Illinois—a distance of 125 miles, with 16 stations—and another between Aurora and Clyde (the end of the Chicago Terminal, a distance of 28 miles. These circuits all covered double track where reverse movements were made.



Selector Set (Open).

Within a short time after the completion of these circuits, and convinced from the results obtained that single track operation presented no problem which could not be solved by the use of the telephone, the Burlington equipped a single track section between Aurora and Savannah, Illinois—a distance of 106 miles, with 23 way-stations.

These installations on the New York Central and Chicago, Burlington & Quincy produced the proof for which many had been waiting, and these roads can justly be called the pioneers in telephone train dispatching. The proof was so conclusive and the results obtained so satisfying that the subject became at once one of world-wide interest. This interest, however, until very recently, did not take the form of installations on railroad systems, except on railroad systems of the United States and Canada, and there are in these countries about twenty railroads which have over 1,000 miles of road equipped with telephones and selectors, the aggregate mileage for these twenty roads being approximately 40,000.

In spite of the success attending the early installations on the New York Central and Chicago, Burlington & Quincy Railroads, there were many things to be overcome before the adoption of the telephone and selector system could be made general. It is a well known fact that a great many of the officials of railroads in this country have come up through the operating departments, and as these men had expressed themselves by means of the Morse key, they had come to consider the telegraph as much a part of the regular operation of the system as to believe it synonomous with quick, safe and efficient operation.

They were disposed to let well enough alone and could not feel themselves free to advocate the use of a system which, to them, was comparatively new and untried. The attitude of the operators themselves also had a somewhat deterring effect on the adoption of the new system. There was a feeling among the dispatchers and operators that the passing of the telegraph would seriously affect their positions. Thus far, however, this has not been borne out, and the railroads have shown every disposition to retain the operators in their old positions. On serious thought this could only be expected, as the welfare of the railroad makes necessary the employment of men who know the railroad business, and in few cases, if any, have operators lost their positions due to the adoption of the telephone, except as a result of some act of their own.

There were many who believed that the telephone would be satisfactory on double and multi-track operation, but there was much skepticism with regard to its use on single track roads. When carefully considered, however, it is believed that any means which would allow the dispatcher to more clearly express himself and thus relieve the traffic problem on double-track roads, would lend themselves with added benefits to the solving of more complex operations on single-track systems. This has been borne out by subsequent events and the single-track divisions are the ones in which the advantages of the telephone system are most apparent.

Selector Set (Closed).

The early prejudices of the dispatchers and operators have been entirely overcome, particularly on divisions where the telephone system has been installed and not one out of the great number of dispatchers with whom I have talked would care to go back to the telegraph method of handling train movements. There are many dispatchers who, through the continual operation of the telegraph key, have developed operator's paralysis in a greater or lesser degree, and these men cannot speak too highly in praise of this system which, as some of them have expressed it, have given them a new lease on life.

The following, taken from an article written by Mr. C. H. Gaunt, formerly Superintendent of Telegraph of the Santa Fe, and printed in the Santa Fe Employees' Magazine, expresses very clearly what has been experienced by many dispatchers:

> "The telegraph is used by the train dispatcher in the intricate operation of his trains for one purpose only—that of communicating with the operators scattered along a stretch of railroad.
>
> "Long use has developed a certainty of action in telegraph manipulation which commands the respect of all, but how often has a half-frantic dispatcher wished

> he could use his voice to the men with whom he must communicate, and thus avail himself of the rapidity of action, the definiteness and the security that would follow."

When it was first thought of utilizing the telephone for the important service of handling train movements, it was at once apparent, in order to make it a success, that some selective device must be developed whereby any particular station, or a number of stations on a long, heavily-loaded line could be called quickly and reliably without interfering with the other stations on the line. Thus, in order for the telephone to be used in place of the telegraph for this class of work, it was necessary to develop a system that would meet the following requirements:

1—Reliable means of selectively signaling one or more stations on a long and heavily-loaded line other than by code ringing.

2—Arrangements permitting the signaling to be done in such a manner as not to interfere with conversation being carried on over the line at the same time.

3—Some indication or answer-back by the dispatcher that the signal bell at the station called, was operated.

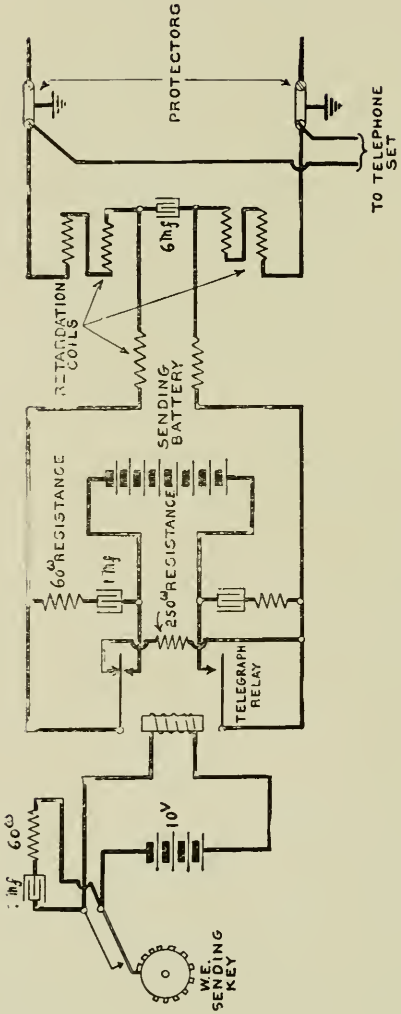
In the attempt to develop a system to meet the above requirements, three selector systems were developed:

1—The series relay selector.

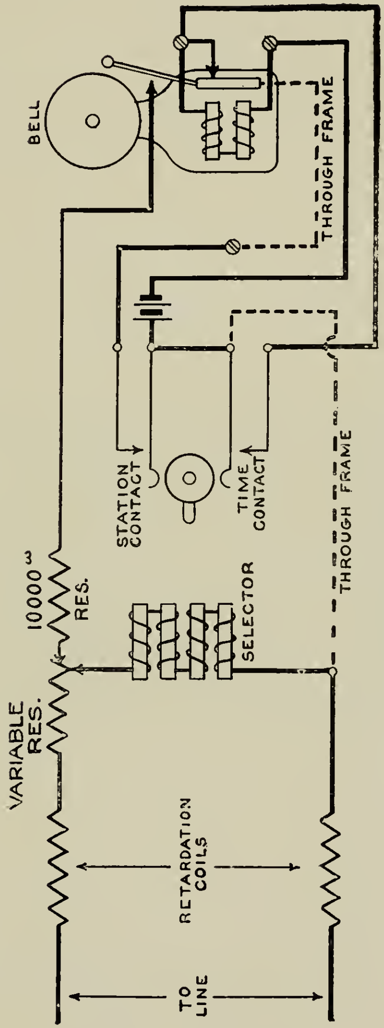
2—The bridged relay selector.

3—The bridged selector system.

The series circuit was fairly satisfactory, but there were a great many disadvantages. In this system the selectors operated from the contacts of a relay, the windings of which were in series with the line, the relays at alternate stations being placed on alternate sides of the line. The principal disadvantages of this system were that it increased materially the resistance and impedance of the circuit, thereby somewhat impairing telephonic transmission; the troubles experienced from inductive effects were more noticeable, due to the unbalanced condition of the line and burn-outs from lightning were much more frequent.



Dispatcher's Selector Circuit.



Way-Station Selector Circuit.

The bridged relay system was a modification of the series relay system in that the relays were wound to a high resistance and were placed across the line instead of being in series. This was somewhat of an improvement over the series system, but was soon replaced by the bridged selector system, in which the selector windings were connected directly across the line, doing away with the necessity of using a relay and thereby reducing the equipment in the selector sets to a minimum and providing a system with only one contact, the function of which was to close the bell circuit. These selectors were wound to a high resistance and the impedance to talking current was such that little or no appreciable loss in transmission was experienced.

There are, at the present time, several selectors which accomplish the desired results and these systems are all of the general bridged selector type.

Dispatcher, Harrisburg, Pa., Penna. R. R.

Pictures of the various selectors will be shown later on the screen and I will describe in detail the operation of the same.

When the selector was first applied to railroad telephone lines as a means of calling, in place of the old code ringing system, the standard local battery telephone sets were used. It was found, however, that the conditions to be met on lines of this character were so severe as to require a special transmission circuit. In the old form of circuit, the receiving circuit was composed of the secondary of the induction coil, the receiver, and the condenser connected in series bridged directly across the line. The total impedance of this part of the circuit to talking current was approximately 600 ohms, about 300 ohms of which was in the receiver and, therefore, active for receiving purposes.

It is obvious that when a number of other sets are bridged across the line at the same time, the combined impedance of the bridges in parallel is very low and the transmission correspondingly difficult between the terminals or widely separated stations. To overcome this trouble it was necessary to design a circuit in which the receiving bridge had a much higher impedance and at the same time arrange the circuit so that this impedance was not inactive, thereby resulting in a considerable loss in transmission.

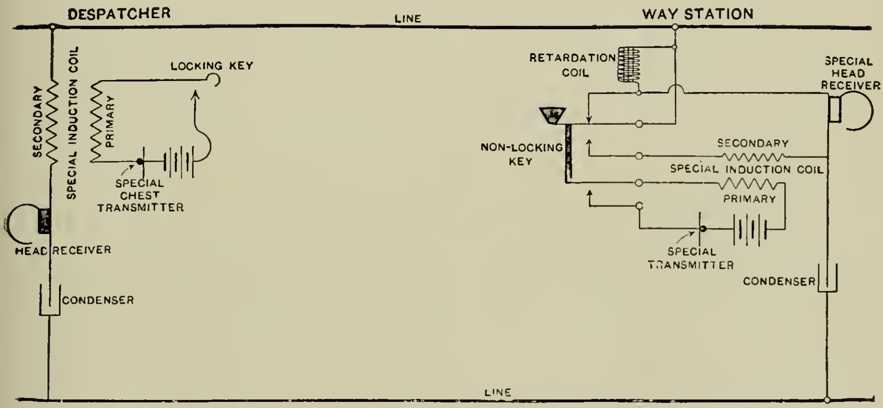


FIG. 2

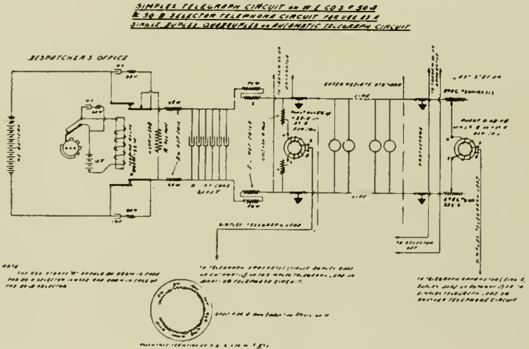
High Efficiency Train Dispatching Telephone Circuit.

The circuit known as the Western Electric standard high efficiency telephone train dispatching circuit was designed by the engineers of that company to meet the severe requirements encountered. A switching device was provided in the circuit to be operated when talking. In the normal position, with the receiver removed from the hook, the receiving circuit connects merely by a condenser and a special receiver bridged directly across the line. The impedance of this circuit is about 2400 ohms to talking current, practically all of which is in the receiver, which is wound to approximately 610 ohms. Normally, neither the primary nor the secondary circuits are closed through the induction coil.

The circuit was arranged in this manner so as to reduce the drain on the batteries when receiving and to obviate the necessity of receiving through the secondary winding of the induction coil, as this would cause a considerable loss in the incoming transmission.

When the switching mechanism is in the operated position the circuit is arranged for talking, as the operation of this switch closes both the primary and secondary circuits through the induction coil and, at the same time, cuts in series with the receiver a retardation coil, the receiver and retardation coil being in parallel with the secondary winding of the induction coil.

The combined impedance of the receiver and retardation coil is high enough so that the outgoing transmission is not noticeably affected, and low enough to allow the dispatcher to break the operator. This circuit is in operation on lines up to 300 miles in length with as many as 45 stations, 20 of which may be listening simultaneously without seriously affecting the transmission.


SIMPLEX TELEGRAPH CIRCUIT ON W.E. CO'S #30-A & 30-B SELECTOR TELEPHONE CIRCUIT FOR USE AS A SINGLE, DUPLEX, QUADRUPLEX OR AUTOMATIC TELEGRAPH CIRCUIT
DESPATCHER'S OFFICE
LINE

Simplex Circuit.

In order to utilize to the fullest extent circuits which have been installed for telephone train dispatching purposes, these lines are being simplexed and phantomed to provide additional telegraph and telephone facilities, without increasing the expense for line construction. The ordinary method of simplexing is to bridge the repeating coil at each end of the line and tap out at the middle points for connection to the telegraph circuit.

This method of simplexing lines on which selectors are operated increases the direct current drain on the signaling battery, and to keep this battery drain within reasonable limits non-inductive resistances are placed between each side of the simplex coil and the line.

Another method of simplexing, which was designed by U. J. Fry, Superintendent of Telegraph of the Chicago, Milwaukee & St. Paul, does away with the simplex coil at the end of the line nearest the dispatcher, and thereby decreases the current drain on the selector sending battery. Circuits showing these two methods of simplexing will be shown on the screen and described in detail later.

Another means of increasing the efficiency of the wire plant where dispatching and message circuits are strung over the same divisions is by making use of the phantom circuit, which consists of applying retardation coils and condensers to the existing message and train circuits in such a way as to secure an additional telephone line without additional line construction; that is, by the use of the phantom circuit in connection with the train and message wires, telephone conversations can be carried on simultaneously over the two pairs of wires. A number of such installations have been made and are proving very satisfatcory.

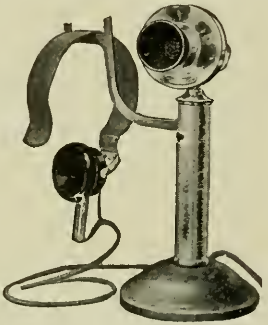
Way-Station, Michigan Central R. R.

Another feature which is of vital importance in train dispatching is the manner in which the lines are constructed and maintained. First of all, in installing telephone train dispatching equipment, it is absolutely essential, if satisfactory results are to be obtained, to have a metallic circuit and use wire such as will provide ample transmission. The wire adopted as standard by most of the railroads for train and message service is No. 9 B. & S. hard-drawn copper, weighing 208 pounds to the mile. Of course, on short lines and branches, iron wire may be utilized and the following figures illustrate the differences which will be obtained in transmission with different sizes of copper and iron wire:

The standard for commercial transmission is rated in terms of No. 19 gauge cable, and the transmission over 30 miles of this cable has been adopted as the limit of standard commercial transmission. The transmission over 900 miles of No. 8 B. W. G. copper, weighing 435 pounds to the mile, is approximately equivalent to that obtained over 30 miles of No. 19 gauge cable. With No. 9 B. & S. copper, 208 pounds to the mile, 500 miles is the limit, and the limit with No. 8 B. W. G. iron is reached at 144 miles. This does not mean that intelligible transmission cannot be obtained over greater lengths of line than given above, but that these figures represent what has been adopted by the A. T. & T. Company as standard commercial transmission.

A comparatively new wire, known as copper-clad wire, which has been largely used by the signal departments of the railroads, should prove very satisfactory for branches and lines up to 200 miles in length. This wire is constructed of copper and steel in such a way that the steel core is entirely covered by copper so welded to the steel that the wire can be drawn very successfully in the smaller sizes.

Copper-clad wire for the shorter circuits has the advantage of increased conductivity as compared with the steel or iron wire



Way-Station Desk Stand.

and an increased tensil strength as compared with copper. The increased tensil strength of No. 9 B. & S. copper-clad wire, as compared with No. 9 B. & S. hard-drawn copper, is approximately 45%, and the conductivity of the copper-clad wire ranges from 30% to 50% that of the same size hard-drawn copper, depending on the grade specified.

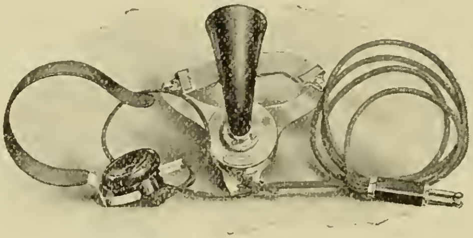
In stringing wires, a careful investigation should be made to find out just what class of service the other wires on the pole are being used for, so that the proper transpositions can be made to avoid trouble from inductive disturbances. It has been found, in the majority of cases, that if the wires are transposed every half mile, little or no trouble will be experienced from this source. In some cases, however, it has been found necessary to cut in additional transpositions on some sections of the line where the exposure is very severe. If the pole lines carry wires which are used for Barclay printing circuits or for quadruplex telegraph service, telephone wires should be placed as far as possible from these. Care should be taken on planning the transposition scheme to have both wires of the pair throughout their entire length subject to exactly the same exposure. This will, in all ordinary cases, neutralize the inductive effects from foreign circuits.

If the ultimate plan is to use the telephone for handling both train and message business, it is advisable to transpose the wires so that phantom circuits can be obtained without the necessity of making further transpositions at the time the phantom equipment is applied to the lines.

A comparison of the telephone and telegraph systems in operation will show the many advantages of the former. With the telephone, the orders are issued verbally by the dispatcher word for word, in place of being sent out by code, and the speed which may be attained is limited only by the ability of the operator to copy the messages. The forms used are the same as with the telegraph, and the operators repeat the orders back to the dispatcher for his O. K.

It is a well known fact that the rate of sending attained by the average railroad telegraph operator is about 25 words a minute, while with the telephone a speed of 100 words or more may be attained.

Experience has shown that 14 to 16 train orders may be put out in one hour with the telephone, while with the telegraph a dispatcher was doing exceedingly well to send out half this number.



Dispatcher's Telephone Set.

The greater speed possible with the telephone is also shown in the reporting of trains, that is, the stating of time of the passing, arrival or departure of trains at stations. The dispatcher is, of course, always in on the line, and, as is customary, the station operator, when wishing to report, merely removes the receiver from the hook and, after being assured that the line is not busy, calls his station name. The dispatcher instantly replies by saying "dispatcher;" the report is then given, usually in the fractional part of the minute.

Information regarding accidents, derailments, etc., are conveyed to the dispatcher verbally by either the operator or the conductor, and the narration is at once so complete that the chances of misunderstanding and the necessity of additional messages are eliminated.

Train Conductor Using Portable Set.

The use of the portable telephone puts the conductor in immediate touch with the dispatcher in case of a breakdown or other trouble between stations, while with the telegraph it is necessary to reach the nearest telegraph office to send in call for help. One of the large roads in the East has over 500 of these portable sets in use, having equipped a large number of the passenger and freight trains and all of the wreck trains with them. Further, the use of siding sets is of great value in that they enable the train crews to reach the dispatcher and keep him advised of their movements.

In some cases the roads have installed semaphore signals at sidings to operate in connection with the selector to enable the dispatcher to set the semaphore against any train desired and have the conductor report by telephone for orders.

Dispatcher's Key Cabinet.

In calling, the selector makes possible the operation of a bell at any station desired by the mere act of turning a button located within easy reach of the dispatcher and corresponding to the station wanted. This answer-back is caused by the making and breaking of the bell contacts across connected in series with the bell and thus producing an inductive effect, which is repeated in the dispatcher's reciver. The fact that the dispatcher has a means of knowing that the bell has operated, coupled with the better signal produced by the ringing of an electric bell, as compared to the click of the telegraph relay or sounder, arouses an immediate response, and the time of calling offices is practically eliminated. Further, if occasion demands, the advantage of calling stations in on the line while a conversation is being carried on may be resorted to. In fact, this feature is used continually on divisions where the traffic is heavy and the rate of calling is high.

If for any reason the first call failed to raise the operator, a second call may be sent out and the bell kept operating at the will of the dispatcher until a response is received.

With regard to the accuracy of the telephone as compared with the telegraph, it may be stated that since the telephone has been used for the directing of train movements, not only since 1907 but also previous to that date, when the equipment had not reached the present state of perfection, not a single accident has been reported resulting from the use of the telephone.

Greater accuracy of transmitting orders is assured, as the dispatcher writes down the words as they are spoken, thus completing his record as the order is given and checking this record, word for word, as the order is repeated back by the operator.

With the telegraph the dispatcher sends his order and the record is made by his copying it as received from the operator. It will be readily seen that with this method the chances of error are greater on account of the liability of the dispatcher not catching errors in the repeat, due to the inclination to write down the message as sent out by him.

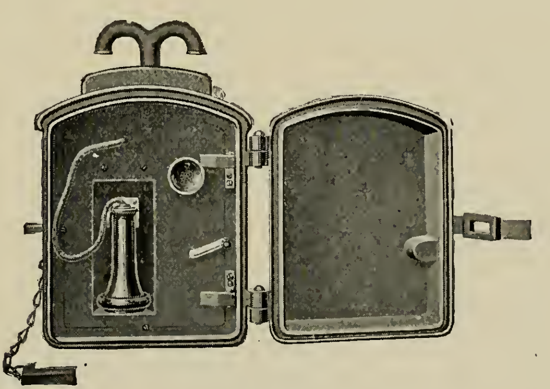
Railway Test Panel.

The ease and speed with which the dispatcher can handle his work is believed by many railroad men to be a further guard against accidents. The increased speed of calling and transmitting allows, more time for laying out the work, planning of meeting points, etc., thus relieving the dispatcher of much of the mental and physical strain of trying to keep traffic moving and the almost continual operation of the telegraph key.

It is claimed by some that the translating of the sounds received over the Morse wire is done automatically. This may be true to a certain extent, but nevertheless this translation requires mental effort and this mental effort should be available for other purposes. Then the physical strain, which sometimes results in operators' paralysis, has a damaging effect under the severe conditions frequently experienced, due to congestion of traffic resulting from wrecks or hold-ups of any other kind.

With the telephone the dispatcher is in closer personal touch with the men along the line than with the telegraph. This is shown by the fact that a number of sharp remarks made over the telephone have greatly decreased or that such occurrences have stopped altogether since the installation of the telephone.

The likelihood of misunderstandings is remote, and this feature can be readily understood by those not familiar with railroad work, if one will consider how much more satisfactory any conversation may be carried on by telephone with a person located at a distant point than is possible by the telegraph or the mails.



Siding Set.

Due to the Federal and State laws limiting the working days of the railroad employes occupied in the receiving and transmitting of orders pertaining to train movements to eight hours, a considerable increase in the number of men necessary for handling the work was effected. Before the passage of these laws the field from which the railroad companies could draw operators was none too large, and the burden of securing the necessary help was greatly reduced by the introduction of the telephone, in that when occasion demanded, men could be taken from the other departments, as the requirements no longer necessitated the ability to send Morse. A field at once opened to trainmen and other employes who had met with such accidents as to incapacitate them for the class of work previously performed.

Under the severe conditions experienced along the Pacific Coast, where the heavy salt fogs make the operation of the telegraph almost impossible, the telephone has been operated satisfactorily on the lines of both the Santa Fe and the Southern Pacific.

In summing up, the advantages which must be conceded to the telephone method of operation are that it is quicker, safer and more reliable, and in addition makes possible better discipline and co-operation between the dispatcher and operator, as well as providing means for officials who are not familiar with the Morse code to exercise supervision and obtain immediate and accurate information in cases of emergency.

With the great increase in the number of telephones for commercial service and the consequent economics effected, it is only to be expected that the use of the telephone for railway service will gradually be extended to embrace many other branches. In fact, this has already been done on some of the more progressive roads.

For handling message or other commercial and routine business between stations, the worth of the telephone has already been proven on several roads, and it is estimated that for this class of business one telephone circuit has the capacity of two telegraph circuits. On roads where the traffic is light, both the dispatching and message work can be carried on over the same pair of wires.

In connection with manual blocking, the old telegraph wires may be utilized, thus providing a grounded block circuit, or, if convenient, a metallic circuit may be employed. Either the grounded or metallic circuit is far superior to the telegraph. Blocking sets or a switching mechanism may be provided to allow one set of telephone equipment to be used on the train, message and block wires, and to cut two blocks into one for night operation.

The loud-speaking receiver is admirably adapted for this service and, it is thought, will ultimately replace the ordinary receiver for block work.

Semaphore Selector, Complete.

Another use for the loud-speaking receiver is in the dispatcher's office, where it may be connected directly to the train wire and relieve the dispatcher of wearing the head receiver at least part of the time.

This instrument, in connection with a special transmitter, may also be used in terminals for announcing trains.

The yard master, in the discharge of his duties, will find the yard circuit of the greatest value in keeping in touch with the various departments over which he has supervision.

For moving trains out of terminals the telephone has, in cases where installed, proven so much quicker and more flexible that there is but little doubt that all terminal circuits will within a short time be telephone circuits.

The train order semaphore, one of the recent developments, which consists of a standard semaphore mast arranged for mounting the selector and telephone apparatus in a weatherproof compartment, can be placed at any point along the line and the telephone and selector connected directly to the train wire.

In the large freight sheds and at transfer points, in office buildings, etc., and in fact at all places where direct communication between parties not located in the same room is desired, the telephone will prove in.

I have a number of slides which illustrate the equipment used, and as they are thrown upon the screen, if there are any questions which any of the members wish to ask, I will be very glad to answer them to the best of my ability.

PRESIDENT: We would like to hear from Mr. Ditch, of the Pennsylvania Railroad.

MR. J. H. DITCH: I do not believe I have anything in particular to say. The paper was very interesting and there is nothing I now recall that I would like to have explained.

There is one thing, however, the simplex feature of the Fry circuit, which is rather interesting. I would like to have Mr. Heyer state just how the relay is arranged so that the telegraph circuit is intact while the dispatcher is calling. In other words, while the selector circuit is in operation, how is the contact maintained for the telegraph work?

MR. HEYER: The relay is arranged with two front and two back contacts, the armature being between the two. The back contacts are made when the relay is not operated. Then the front contacts, when it is operated, make just before the back contacts break, so that you always have a continuity in the circuit through the relay contacts. The inner contacts are wired to the outside terminals of the sending battery and the middle point of the battery is connected to a telegraph tap. Does that answer the question?

MR. DITCH: Yes. I would like to ask, also, is there much trouble experienced in keeping the adjustments of that relay?

MR. HEYER: There has not been, as far as I know, any trouble with the adjustments of the relay. The principal trouble with this circuit has been to get the retardation coils and the resistance in the line properly balanced so that you can use it for duplex and quadruplex operation. It works very satisfactorily for straight Morse.

MR. DITCH: The difficulty in operating duplex? I do not understand why the unbalancing would injure the duplex operation.

MR. HEYER: The noise is not so apparent in the duplex as in the quadruplex. It is principally from the higher frequency, and that is more apparent with the quadruplex than with the duplex.

Mr. DITCH: The difficulty, then, is in causing noise in the telephone circuit?

MR. HEYER: That is it.

PRESIDENT: May we hear from Mr. G. W. Butts?

MR. G. W. BUTTS: Mr. President, I do not think of anything in particular to add to what the speaker has said. It occurs to me, however, that there might possibly be in this assembly a few doubters as to the feasibility of the telephone for railway operation. I happen to be connected with a division of the Pennsylvania Railroad on which there is not a single telegraph instrument in service, with the exception of those at the division terminal, which are used for working with the connecting division and on those circuits beyond and off our division territory. There has been, since the spring of 1910, nothing but telephone operation on the division itself for message work, train dispatching and train blocking, and it has been entirely successful.

PRESIDENT: Mr. Lee, Superintendent of Telegraph of the P. & L. E. R. R., may we hear from you?

MR. L. A. LEE: I do not know that I have anything to say, except that I have enjoyed the paper very much.

PRESIDENT: Mr. W. R. Smith, Division Operator of the P. R. R.?

MR. W. R. SMITH: I have nothing to say, Mr. President.

PRESIDENT: Mr. S. M. Boush, of the P. R. R., may we hear from you?

MR. S. M. BOUSH: Mr. President, I do not believe I have anything in particular to say. There is one point, however, that I think the demonstrator has not brought out in particular, the fact that the selector eliminates the feature of the instruments conneced along the line sounding in each office connected on that line. The point I have in mind is that, with the Morse, as well as party line telephone systems, each station hears the call or signal of every other station connected on the line, and, therefore, the operator at each and every station becomes familiar with the clicking of the Morse or the signal on the line, and he naturally becomes a little bit careless and waits a while to pick out his own signal. The selector eliminates that feature, which I think is very good. I have nothing further.

PRESIDENT: Mr. F. M. Brown, of the P. & L. E. R. R., may we hear from you?

MR. F. M. BROWN: I do not know that I can add anything further to what has already been said on the subject of train dispatching by telephone. I have enjoyed the paper very much, yet there are some features of train dispatching by telephone that have not yet been brought out, one of which is the fact that the telephone operator is not able to keep in touch with the position of the trains on the road for the reason that they do not hear them reported from each station until they come in on the circuit, while with the Morse they are better able to hear trains reported and to keep in touch with the position of them on the line as they pass each station. However, there are many other features in connection with train dispatching by telephone that offset this. For instance, the time put in by the dispatcher in calling various offices, which is entirely eliminated by the selective calling device. While I have been endeavoring to follow up the development of train dispatching by telephone closely there was one feature mentioned by the speaker with which I was not familiar. Heretofore my knowledge of dispatcher's circuit was that no station on the line could communicate with another station without first calling the dispatcher, and the dispatcher in turn calling that station for the other, which is the most commendable feature connected with the dispatcher's circuit. The speaker described a device which made it possible for one way station to call another without securing permission from the dispatcher, which would take out of the hands of the dispatcher the complete control of the telephone circuit. The Morse train dispatcher is continually annoyed by way stations calling each other and carrying on unnecessary conversation on the train wire ,and this device, if applied to train dispatcher's circuit would certainly not improve this condition. I have had considerable experience with the portable telephone sets used with wreck train service, just described, and can say it has proven a great deal more satisfactory than the Morse in handling trains around wrecks and against the current of traffic. It permits the keeping in close touch with the dispatcher and trains can be handled with much less delay than is possible with the old-time Morse system.

MR. HEYER: Regarding the first point brought out by Mr. Brown, the fact that the operators are not in touch with everything that goes on over the line, I have heard a great deal of comment on that subject, both pro and con, and among the operating people there seems to be a division of opinion. Some of them claim that even if the operators are not in touch with everything that goes on over the line, it does not make any difference; some take the other side of it. But, in the main, most of the people with whom I have talked claim that it is not a very serious matter. That is something that the operating people themselves, familiar with the conditions under which they operate, would be much better able to judge than I, because there are certain conditions, I suppose on some divisions where it does not make any difference, and there may be other divisions or other classes of service where it does make a difference.

Regarding the portable telephone system for wrecks, I might say that in talking with some of the Lackawanna people a few weeks ago, they claim that what wrecks they have had since they put in the telephone system, they have been able to save from one to two and in some cases three hours of the time in clearing away those wrecks, and they have determined that it cost them upwards of a thousand dollars an hour to hold up traffic on their road, and the use of the portable telephone has saved them in every case from $1,000 to $3,000 in every wreck they have had.

With regard to stations calling among themselves, the inter-calling circuit is designed principally for message service and not for train dispatching service, and there are no cases that I know of where that circuit is being used for handling train movement. On train circuits, the dispatcher has complete control of the line, and if a station wishes to talk with another they get permission from the dispatcher. This inter-calling system is for message work where the chief operator is not on duty 24 hours in the day and where there is a large interchange of business between the various stations, it is not used for the train circuit.

PRESIDENT: Mr. Isler, of the Monongahela Division, P. R. R., may we hear from you?

MR. A. G. MITCHELL: I might answer for Mr. Isler, he having left the meeting. The Monongahela Division, on which Mr. Isler is Division Operator, has had for probably eight years or more train dispatching by telephone on the single line branch known as the Red Stone Branch, commencing first with the magneto system and finally, a few years ago, installing the selector. And I can say for the operation of that branch under the telephone service, that we have in all that time never had an accident due to the telephone train dispatching.

PRESIDENT: Are there any others that would like to ask Mr. Hever any questions on this paper?

MR. F. H. STARK: I am sure we all concede that this has been a very interesting and instructive subject, very ably presented. I would move you that we extend a vote of thanks to Mr. Heyer for this privilege.

The motion was duly seconded and carried unanimously.

PRESIDENT: Mr. Heyer, please accept the thanks of the Club, which I now tender to you.

MR. HEYER: I thank you most sincerely.

There being no further business to come before the meeting,

ON MOTION, Adjourned.

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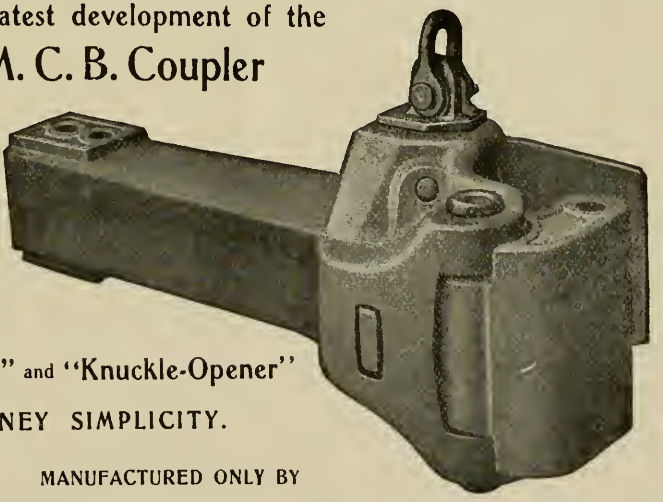

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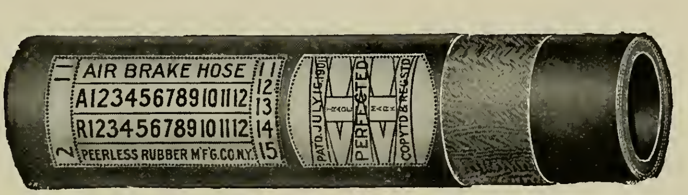

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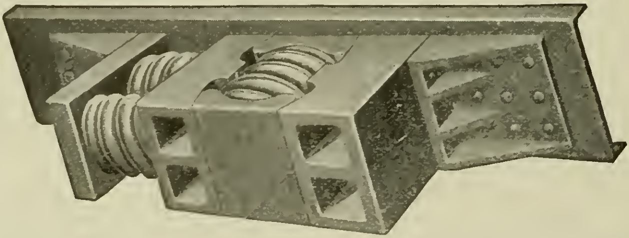

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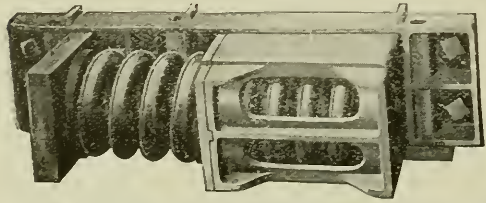

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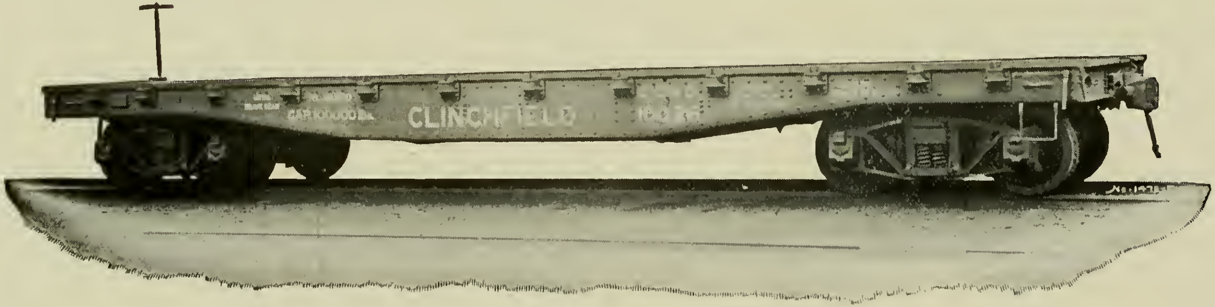

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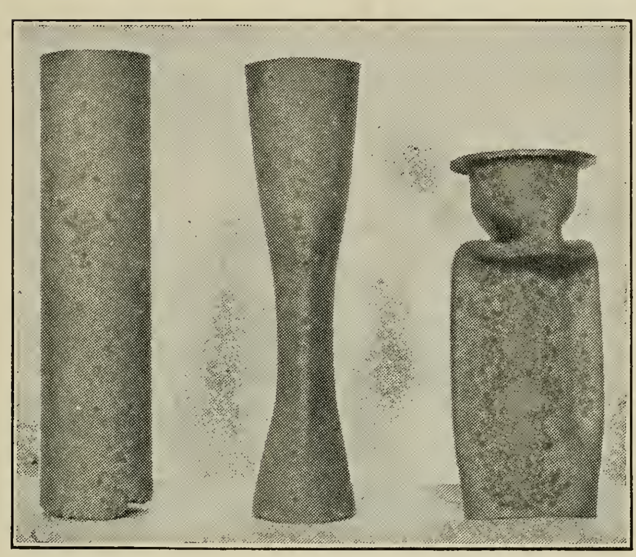

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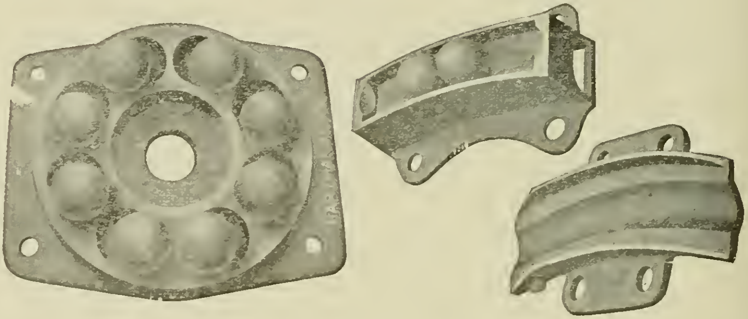

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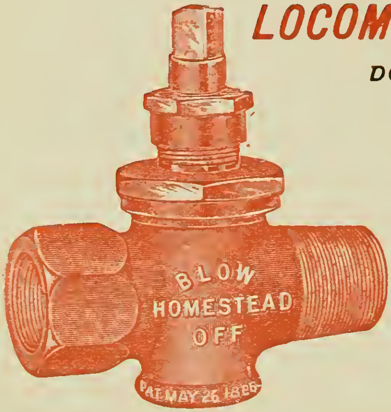

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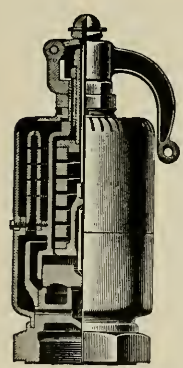

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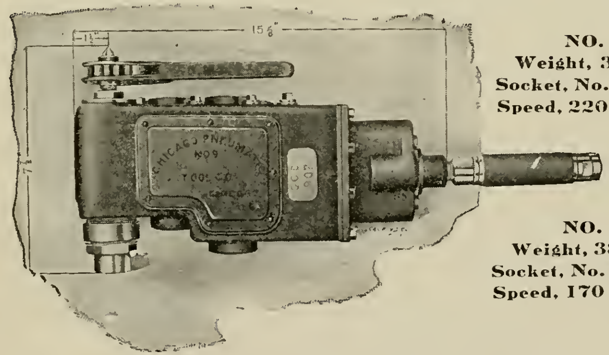

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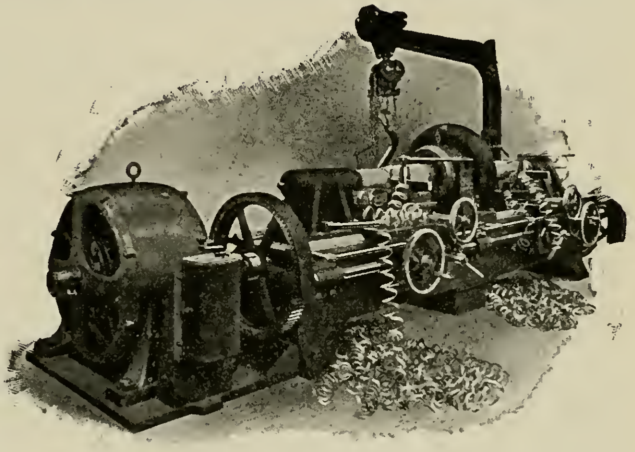

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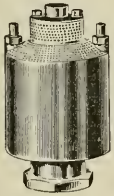

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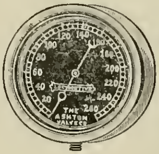

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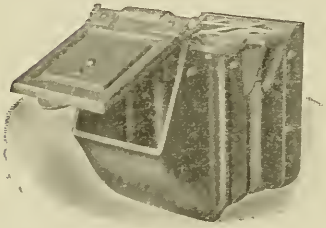

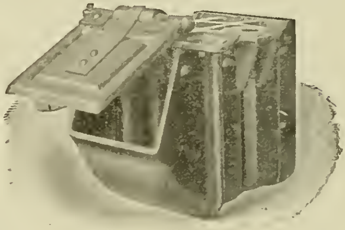

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ORGANIZED OCTOBER 18, 1901.

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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING, MARCH 22nd, 1912.

The regular monthly meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., with President F. R. McFeatters in the chair.

The following gentlemen registered:

MEMBERS.

Adams, Chas. B.
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Beatty, E. A.
Bennett, R. G.
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Ferren, R. O.
Forsythe, Geo. B.
Froelich, J. H.
George, M. E.
Gilg, Henry F.
Grieve, H. F.
Guy, W. A.
Harner, A. J.
Harriman, H. A.
Haynes, J. E.
Herrold, A. E.
Higgins, H. L.
Hoffman, C. T.
Howe, D. M.
Howe, Harry
Huyett, E. G.
Jenny, Jacob
Johnson, W. A.
Jordon, J. E.
Kennedy, Jas.
Kinch, L. E.
Kinter, D. H.
Kleine, R. L.
Knight, E. A.
Lynn, Samuel
Macfarlane, W. E.
Mackert, A. A.
Mensch, E. M.
Miller, F. L.
Mitchell, A. G.
McCartney, J. G.
McDermitt, W. W.
McFeatters, F. R.
McKeon, J. W.
McNulty, F. M.
O'Connor, M.
Orchard, Chas.
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Porter, C. D.
Postlethwaite, C. E.
Rea, C. S.
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Rivinius, C.
Rohn, W. B.
Rowe, M. L.
Ryan, W. F.
Sharpley, H. G.
Shallenberger, C. M
Shourek, Theo. L.
Smith, M. A.
Smith, Russell
Stark, F. H.
Stark, J. L.
Stucki, A.
Taylor, F. C.
Walter, W. A.
Walther, G. C.
Wells, J. F.
Wescoe, F. B.
Wood, Ralph C.
Wyke, J. W.

VISITORS.

Blair, H. A.
Boring, T. J.
Boughton, A.
Brown, W. S.

Cassiday, C. R.
Dresser, G. M.
Eaton, C. B.
Eberhardt, A. C.
Garrett, Walter
Gross, C. H.
Hoffman, A. J.
Holsinger, F.
Humphrey, C.
Mills, C. C.
Morrow, W. M.
Murphy, E. S.
Nelan, E. J.
Nicholson, W. S.
Norris, W. K.
Orr, A. M.
Patterson, J. T.
Rankin, B. B.
Shremp, J. A.
Smith, A. C.
Stiefel, H. C.
Tarr, Geo. B.
Taylor, J. A.
Theisen, W. C.
Thompson, H. H.
Towson, T. W.
Yergy, H. J.

PRESIDENT: The minutes of the last meeting are in print, therefore we will dispense with the reading of the same.

The Secretary read the following list of applicants for membership:

Beaumont, C., Sales Agent, Grip Nut Co., Baltimore, Md. Proposed by R. L. Kleine.

Blair, Harry A., General Car Foreman, B. & O. R. R., No. 252 Renova St., Pittsburgh. Proposed by J. B. Anderson.

Brooks, Walter A., Assistant Foreman, Boiler Shop, Penna. Lines West, No. 3211 East St., Pittsburgh, N. S. Proposed by W. J. Murphy.

Christy, F. X., Enginehouse Foreman, Penna. R. R., No. 255 Forty-fourth St., Pittsburgh, Pa. Proposed by J. B. Anderson.

Dress, George M., Maintenance Engineer, American Locomotive Co., No. 206 Grant Ave., Bellevue, Pa. Proposed by E. A. Beatty.

Egan, W. T., Train Master, B. & O. R. R., Newark, O. Proposed by A. W. Crouch.

Garrett, Walter, Shop Engineer, American Locomotive Co., No. 327 Lincoln Ave., Bellevue, Pa. Proposed by H. G. Sharpley.

Hinken, E. H., General Foreman, B. & O. R. R., Glenwood, Pa. Proposed by M. O'Connor.

Huchel, John, General Foreman, Standard Car Co., No. 424 Garfield Ave., New Castle, Pa. Proposed by W. J. Murphy.

Kirkpatrick, Jas., Master Mechanic, B. & O. R. R., Newark, Ohio. Proposed by A. W. Crouch.

Lichtenfels, P. H., Foreman, No. 2 Repair Yard, P. R. R., Pitcairn, Pa. Proposed by J. F. Courson.

May, F. J., Salesman, Chicago Pneumatic Tool Co., No. 10 Wood St., Pittsburgh, Pa. Proposed by M. O'Connor.

Miller, H. M., Water and Coal Inspector, Penna. R. R., Box 414, Derry, Pa. Proposed by J. B. Anderson.

Mode, H. C., Salesman and Engineer, W. E. & Mfg. Co., No. 421 Ross Ave., Wilkinsburg, Pa. Proposed by J. F. Courson.

Mourer, Chas. W., General Foreman, Pressed Steel Car Co., No. 177 Dakota St., Bellevue, Pa. Proposed by J. M. Ranck, Sr.

McNeil, M. C., Salesman, Westinghouse Machine Co., No. 500 Westinghouse Bldg., Pittsburgh. Proposed by J. F. Courson.

Patterson, Jas. T., Chief Clerk, Penna. R. R., No. 446 Caldwell Ave., Wilmerding, Pa. Proposed by A. A. Mackert.

Pratt, L. P., Rep., Yarnall Paint Co., No. 1026 Race St., Philadelphia, Pa. Proposed by J. B. Anderson.

Richey, C. W., Master Carpenter, Penna. R. R. Co., 814 N. Linden Ave., E. E., Pittsburgh. Proposed by J. B. Anderson.

Smith, John H., Foreman, No. 3 Repair Yard, Pitcairn Shop, P. R. R., No. 570 Second St., Pitcairn, Pa. Proposed by J. F. Courson.

Steifel, H. C., Chemist, Gallatin, Tenn. Proposed by D. M. Howe.

PRESIDENT: When these applications have been favorably acted upon by the Executive Committee the gentlemen will become members.

We will now listen to the report of the Standing Committee on the revision of the Master Car Builders' Rules of Interchange. Mr. R. L. Kleine, Chairman of the Committee, will read the report, and at any point where there are any suggestions to make, he asks that you make them right at the time when the section is read.

REPORT OF STANDING COMMITTEE ON REVISION OF M. C. B. RULES OF INTERCHANGE.

Mr. President and Gentlemen:

Your Standing Committee on the Revision of M. C. B. Rules of Interchange sent out the usual circular to the members requesting recommendations for any desired changes in the rules, to which no response was received, indicating that either the rules do not require revision or the members have not found time to reply to the circular. The Rules of Interchange are important to all the railroad members of the Club, and your Committee begs to offer the suggestion that in the future each member submit to the Committee any recommendations for changes in the Rules he may have in mind, even though such change may seem trivial. Any recommendations thus submitted will receive the careful consideration of your Committee.

The Executive Committee of the M. C. B. Association appointed a Special Committee to make recommendations for the revision in the prices, covering labor and material as well as settlement prices for cars. This Special Committee sent a circular to all members of the M. C. B. Association asking for a reply not later than December 1st, 1911. On account of the short time allowed the date was extended to January 15th, 1912, but as that date has already passed, your Committee has refrained from making any recommendations for changes in regard to prices.

In general, the Rules of Interchange, as revised in 1911, have given satisfaction. These rules have been carefully considered by your Committee, and we give below our recommendations for changes in these rules, which we consider essential to bring them up to date:

PREFACE.

Last paragraph, third line. Insert after Code of Rules: *Requirements for tank cars.*

Explanation: The requirements for tank cars have been adopted as a standard of the M. C. B. Association, and the rules should be extended to cover that tank cars will be inspected in accordance with these requirements, which is the general practice.

RULE No. 1.

Fourth line. After *brakes* insert *including tightening unions and adjusting angle cocks to the proper angle.*

Explanation: At the present time roads are charging for this work, whereas others are not. This is causing controversy, and we consider that these charges are too small to justify billing, and if billed for by all roads would simply be offset charges.

RULE No. 2.

Fifth paragraph. Eliminate the words *and cars not loaded in accordance with Rules for Loading Materials,* the remainder of this paragraph to form a separate paragraph.

Explanation: To provide that the receiving line shall transfer or re-arrange the lading instead of returning such shipments to the delivering line, in order to expedite the movement of freight. The rules now provide that loaded cars offered in interchange must be accepted and change recommended includes lading on open cars, whereas, at present it is permissable under the rules to reject cars not loaded in accordance with the rules for loading materials.

Add a new pargraph after fifth paragraph to read: *A. C. T. check is to be used when authorizing the transfer or rearrangement of lading of the form shown on page —.* (See Exhibit A.)

Explanation: To provide a definite arrangement authorizing the transfer and checking of responsibility covering such cases. At present this matter is being handled by letter authority or by issuing an M. C. B. defect card. As the responsibility of per diem as well as the responsibility for the transfer of lading is involved it is felt that this matter can be handled to better advantage by the use of a blank form properly filled out.

RULE No. 9.

A. Change second item under M. C. B. coupler or parts thereof to read: *Steel applied, or steel or malleable removed.*

Explanation: Under the M. C. B. Rules it is prohibitive to apply malleable iron couplers to foreign cars in repairs. See Rule No. 19.

Send bill and this check card to

EXHIBIT "A"

M. C. B. ASSOC.—AUTHORITY FOR TRANSFER OR ADJUSTMENT OF LADING.

(Name of Road)

Date..............................

Lading..

Transferred. Account of..

....

....

Issued to ....R. R...

Car No...................Initial...

Inspector at..

Note: To be printed in black on white paper in duplicate form, filled out with ink or black indelible pencil. Original to accompany bill and duplicate retained for record.

B. Under M. C. B. couplers or parts thereof, add a new item as follows: *On coupler with key attachment applied and removed.*

Explanation: There should be a separate price in the rules for a coupler with key attachment removed and replaced, therefore, provision should be made for a proper notation on the repair card. We would recommend two (2) hours.

C. Under the heading of *Wheels and axles removed and replaced*, add a new item: *Kind of truck.*

Explanation: To give proper information on the repair card, so that correct charges can be made for the kind of truck to which the wheels and axles are applied.

D. *Triple valve R. & R.*, substitute for the word *kind* the following: *Name of maker and type.*

Explanation: To give the car owner proper information as to the particular type of valve replaced.

E. Next to last paragraph on the subject of *Triple valve or cylinder cleaned*, second line, change the word *Last* to *Previous.*

Explanation: The meaning of this rule is misconstrued by inspectors and others. It is intended to show on the repair card the date of the previous cleaning.

RULES Nos. 10 and 98.

Referring to the portions of these two rules which relate to the steel and steel tired wheels, we would call attention to the fact that these rules now provide for measuring the thickness of the tire for wheels applied and removed irrespective of the condition of the flange and tread, thus not taking into consideration actual wear metal of the treads. In order to interchange these wheels equitably the exchange should be made on a basis of full contour.

On account of the difficulty in definitely determining the thickness of tire under all conditions of wear of flange and tread this phase of the question has not been covered in the rules.

A gauge for accurately determining the wear metal of tire under the various conditions of worn flange and tread has been gotten up under the jurisdiction of Mr. W. C. A.

Henry, Superintendent of Motive Power of the Southwest System, Pennsylvania Lines West of Pittsburgh, Mr. C. F. Thiele, General Car Inspector, Southwest System, having developed the gauge which is shown on Exhibit "B". This gauge is so designed that when placed upon the worn wheel it will register not only the thickness of the tire when turned down to full flange and tire, but also shows the amount of metal which must be removed from the worn wheel to obtain the full contour. The sum of these two dimensions is the thickness of tire before turning. This thickness of tire before turning can also be determined from this gauge without making the addition. The gauge is used in the following manner: Slide the plate containing the full contour to the top of the gauge and withdraw the registering points. Move the point "B", which engages in the witness groove of the tire, to the right, then place the gauge upon the wheel, so that the back of the flange will be in contact with the vertical surface of the gauge, with the fixed point "A" resting upon the tread (this fixed point "A" is located at the point where the thickness of the tire is measured). With the gauge held in this position insert the hing point "B" in witness groove, then drop the sliding points "C", "D", "E", and "F" until they come in contact with the flange and tread. Remove the gauge from the wheel by moving point "B" to the right, and after the gauge has been removed swing the point "B" into place. Slide down the full contour lines until the new contour covers all of the points of the gauge. The thickness of the tire after turning is indicated on the graduation marks of the slide "B" by the pointer "G" and the amount of metal to be turned off is indicated on the graduation marks on the plate by line "H". The thickness of the old tire before turning is the sum of these two graduation marks.

Your Committee feels that this gauge accurately determines the thickness of tire both before and after turning, and with the view of changing the present rules and basing the interchange of wheels on full flange and tread contour would respectfully suggest that this gauge be referred to the Arbitration Committee with the view of obtaining their approval as to the desirability of interchanging steel and steel tired wheels on this basis, and if so approved that the gauge be referred by them to the Wheel Committee for approval, and presented to the Association. (See Exhibit "B".)

RULE No. 12

At the end of first paragraph add the following sentence: *If repairs are not correct at time of the inspection the joint evidence card shall be attached to the car.*

Explanation: To indicate to the shops at which repairs are made that joint evidence has been taken, and also to avoid duplication of joint evidence should car be subsequently interchanged at another point.

RULE No. 18.

Third paragraph. Change last two lines to read: *Part or parts must be renewed to bring coupler within gauge, otherwise coupler must be replaced; in either case owners are responsible. (See drawing P*-11).

Explanation: As the rule reads at present it would indicate that the coupler must be replaced in all cases, which is not the intention or practice.

RULE No. 20.

Fifteenth line. Change the word *Shank* to *Head.*

Explanation: To conform to the method of measuring followed by the Interstate Commerce Commission Inspectors.

RULE No. 21.

Third line. Insert after the word *Rails* the following: *On cars originally equipped with running boards.*

Explanation: To indicate that this provision is only intended to apply to house cars.

RULE No. 33.

Fourth line. Omit the word *Also* and show a comma instead of semi-colon after the word *Cars.*

Seventh line. After the word *Caps* insert the words *Vent slides.*

Explanation: The first change is recommended to clarify the rule, and the second suggestion is to include missing vent slides in Owner's Responsibility when cars are offered in interchange, for the reason that these vent slides are insecurely fastened and are lost in transit. The owner should properly secure these vent slides, which will avoid their loss.

RULE No. 35.

Add a new paragraph, as follows: *After September 1, 1915, cars equipped with stem or spindle attachment couplers, or strap attachment couplers with vertical pin, or American continuous draft rods will not be accepted in interchange.*

Explanation: The above coupler attachments are inadequate for present day service, therefore, a time limit should be set when these weak attachments are not to be accepted in interchange. This will give due notice to owners to make the proper changes in their equipment.

COMBINATIONS OF DAMAGES.

RULES Nos. 37 to 52 Inclusive.

Referring to Arbitration Decision 852, we believe the Combinations of Damages as relating to same end of car should be designated under each rule in order to have each rule thoroughly understood, therefore, would recommend the following:

Omit from heading *If existing at the same end of car.*

Rule No. 37. Add to the end of rule *At same end of car.*

Rule No. 38. Add to the end of rule *At same end of car.*

Rule No. 39. Add to the end of rule *At same end of car.*

Rule No. 40. Add to the end of rule *At same end of car.*

Rule No. 41. Add to the end of rule *At either end of car.*

Rule No. 42. Add to the end of rule *At same end of car.*

Rule No. 42. Change the last foot-note under this rule to read: *It will be assumed that the missing coupler attachments are not damaged unless known to the contrary.*

Explanation: Present rule 42 assumes that the missing coupler is damaged, whereas, rule 95 provides that labor only can be charged for replacing missing couplers, including yokes, springs, and followers when lost with couplers, therefore, establishing that when these parts are lost or missing they are not damaged. This assumption we find is borne out in practice. It is not logical that we should assume in one rule that missing parts are not damaged and in another rule that missing parts are damaged.

RULE No. 52.

Fourth paragraph. Insert after the word *Use* the words, *To secure safety appliances.*

Explanation: To express the meaning clearly.

RULE No. 53.

Combine the three paragraphs under one paragraph and omit dates, to read as follows: *All freight cars offered in interchange must be equipped with air brakes, M. C. B. standard 1¼- inch train line, angle cocks, quick action triple valves and pressure retaining valve.*

RULE No. 60.

Second paragraph. Change the word *Should* to *Must.*

Explanation: Some roads are cleaning the triple valves on the cars and not submitting them to the M. C. B. test rack for approved test, and are charging the same price as for doing the work properly. All triple valves cleaned should be tested on an M. C. B. test rack in order to insure their being in proper condition, for which reason rule should insist upon the triple valve being removed from the car and submitted to the M. C. B. test rack.

RULE No. 64.

Change the last clause of this rule to read: *Except nuts and journal box lids.*

Explanation: There is now some controversy as to the meaning of this rule, some interpreting that the exception covers only journal box nuts, whereas, it is the intention of the rule to cover in the exception all missing nuts from the truck.

RULE No. 91.

Page 44. Change last sentence of paragraph at top of page to read: *The receiving road shall at once issue separate counter-billing authority to cover the acknowledged error on form shown on page —, said form to be attached to the bill.* (See Exhibit "C".)

Page 44, second paragraph. Change last clause to read: *Correct number shall be furnished or counter-billing authority given covering amount of charge.*

Explanation: These changes to conform to general practice. The use of a blank for counter-billing authority is pre-

EXHIBIT "C"

M. C. B. ASSOCIATION—COUNTERBILLING AUTHORITY

(Name of Railroad)

Place....................191....

This will Authorize the..Railroad Company

to counterbill the...............................Railroad Company

....Dollars

to offset overcharge in our bill No............Amount, $............

$.............. ....

This authority must be attached to bill. Signature of Person Issuing.

ferred to letter authority, as the same can be more readily handled and filed in connection with the repair and defect cards; a good many roads have already adopted some particular form of blank and it would be well to have a standard blank for this purpose.

RULE No. 94.

Add to the bottom of this rule: *Except in the case of damage covered by defect card. If the car is destroyed or dismantled bill may be rendered on authority of the card.*

Explanation: Cars of low capacity are being retired on certain roads when the damage or repairs amount to a certain sum. Where a foreign road damages a car and on account of which damage the owner tears down the car, the owner should be reimbursed to the extent of the damage for which the foreign road is responsible.

RULE No. 98.

DELIVERING LINE DEFECTS.

Change this rule to permit charging the owner for increased service metal in wheels applied, by making the following changes:

Sixth paragraph, Page 47, third line. Change the words *But no* to *And.*

Seventh paragraph, Page 48, eighteenth line. After the word *Owner* introduce a period and cut out remainder of this paragraph.

Explanation: The delivering road, according to the present rules, is twice penalized; first for the loss of service metal for damage to the wheel, for which the delivering line is responsible, and in cases where they do not have on hand wheels of the same tire thickness and must apply wheels with increased thickness of tire, the delivering line is again penalized, and the owner obtains direct benefit. As the owner is benefited by the increased service metal in the wheels applied we feel that the owner should be perfectly willing to pay for this increased service metal.

RULE No. 101.

Add new items, *Brake Beams,* as follows: *One new M. C. B. No.* 1 *brake beam,* $2.75; *one new M. C. B. No.* 2 *brake beam,* $3.75.

Explanation: Inasmuch as the Association has now established standard No. 1 and No. 2 brake beams, and Rule No. 17 provides that it is permissible to apply standard M. C. B. brake beams, provided no change in length of hangers or other details is required, it is felt that the prices should be incorporated in the rules for these No. 1 and No. 2 brake beams when new.

We would also recommend that the Train Brake and Signal Committee be instructed to provide some means of identification for No. 1 and No. 2 M. C. B. standard brake beams. As a suggestion would recommend that "M. C. B. No. 1" or "M. C. B. No. 2" be cast in raised letters on the top of the strut of the beam.

RULE No. 102.

That provision be made in this paragraph authorizing a charge for labor and material for restenciling car when the initials or numbers are illegible, also a charge for correcting a wrong letter or figure in the initial or number. In order to make this rule No. 102 positive, as well as incorporating this change, we would suggest that Rule No. 102 be reworded as follows: *One pound of mineral paint to be charged for* 15 *square feet of surface covered and one pound of lead paint for* 12 *square feet of surface covered, no charge to be made for lettering except in cases where the letters or figures are restenciled on account of being inellegible or where wrong letter or figure is corrected in the initial or number.*

LOADING RULES.

We received a communication from the B. & L. E. Railroad relative to certain changes recommended in the Rules for Loading Materials, which questions were originated by the Carnegie Steel Company. Inasmuch as there is a Standing Committee of the M. C. B. Association on Rules for Loading Materials and as these recommendations have already been submitted to that Committee by the various roads in the Pittsburgh District, your Committee on M. C. B. Rules of Interchange did not believe it was within their province to take up this matter, therefore, refers this matter to the Executive Committee of The Railway Club of Pittsburgh. In the opinion of your Committee no further action is required.

In concluding this report your Committee desires to express their thanks and appreciation to the Club for the arrangements made for the stay of the members of the Committee while in Pittsburgh considering these rules.

Respectfully submitted,

C. E. BOYER,
Pennsylvania Railroad, Lines East of Pgh.
G. E. CARSON,
N. Y. C. & H. R. Railroad.
S. A. CROMWELL,
B. & O. Railroad.
F. W. DICKINSON,
B. & L. E. Railroad.
G. N. DOW,
New York Central Lines.
W. J. KNOX,
B. R. & P. Railroad.
S. LYNN,
P. & L. E. Railroad.
F. M. McNULTY,
Monongahela Connecting R. R.
O. J. PARKS,
P. F. W. & C. Railway.
J. B. SWANN,
P. C. C. & St. L. Railway.
F. H. STARK,
Montour Railroad.
R. L. KLEINE, *Chairman,*
Pennsylvania Railroad, Lines East of Pgh.

March 7th, 1912.

Since the report of your Committee has gone to the printer, we received recommendations for changes in the rules from the following:

Chas. S. Stark, Foreman, Car Department, Hocking Valley Railway Co.

Chas. Waughop, Chief Interchange Inspector, American Association of Railroads, St. Louis Division.

H. Bonett, Foreman Executive Committee, Joint Interchange Car Inspectors and Car Foremen's Association of America.

W. K. Carr, General Car Inspector, Norfolk & Western R. R. Co.

Rule No. 2: It is recommended that this rule should specify that transfer order, where delivery line would be responsible, should not be granted, if car can be repaired under load inside of 24 hours, to put car in condition to carry load to destination.

Your Commitee does not approve of this recommendation as it reads, but believes some restriction is necessary, so as to avoid general transfer of lading, as this should only be done where the repairs can be made without the necessity of transfer, and we would, therefore, suggest that this matter be fully discussed.

Decision: Hold over for another year.

Rule No. 2: Eliminate from the fifth paragraph of this rule, "That receiving line may reject leaking tank car."

Explanation: The elimination of leaking tank cars in rule No. 2 is made in accordance with the ruling of the Committee on Handling Explosives and Inflammables.

Recommendations: We would suggest that this part of the fifth paragraph of Rule No. 2 be changed to read: "Loaded cars offered in interchange must be accepted, except leaking tank cars, which must be repaired or the lading transferred at the nearest available point, whether that be on the receiving or delivering line."

Decision: Approved.

Rule No. 33: Suggested that the item of center door post of automobile cars be considered inside or concealed parts.

Recommended that this be freely discussed.

Decision: Not approved.

Mr. Chas. Waughop: The only thing that I care to submit to the Pittsburgh Railway Club is that you are probably aware of the agitation going on throughout the country regarding carding with M. C. B. defect card for all defects cardable when offered in interchange; this will, no doubt, be a coming event in the very near future. For the purpose of simplifying and reducing to the minimum the carding of cars, I would submit a recommendation I made to the Chief Interchange Inspectors at Washington, D. C., in 1910, abstract of which is:

> "All cars offered in interchange with defects which could have been charged to the owner by delivering line prior to interchange, shall be received and if repairs are made by receiving line shall be charged to the owner."

In other words, my recommendation is that all mention of penalizing items for not making repairs of defects on cars offered in interchange be stricken from the rules. This would reduce carding of cars throughout the country fully 20% and do away with a whole lot of double charging.

Explanation: Committee stamps with approval the agitation going on throughout the country relative to carding with M. C. B. cards all defects cardable when offered in interchange.

The Committee is not in favor of letting down the bars and permitting cars to be interchanged with missing material and the delivering company relieved of responsibility. That, in our opinion would result in lower maintenance than at present, in which we do not concur.

We would recommend a full discussion.

Decision: Not approved.

Rules 37, 38 and 39: It is suggested that the combination of defects in these rules more plainly show intention of rule pertaining to combinations: Damaged coupler body or pocket, accompanied by damage to end sill, draft timber or longitundinal sill. Does this or does this not include damage to coupler body or pocket to form the combination?

Decision: The rules in this particular are plain, as they read that the coupler body or coupler pocket must be damaged, in addition to the other items mentioned, in order to form the combination.

Rule 42: Suggest the elimination of this rule and rely entirely on the first paragraph of Rule 32; in other words, consider the box car the same as gondola. End posts broken from the inside out by lading shifting be considered owner's defect; broken from the outside, due to being struck by adjacent car or lading, delivering company's defect.

Explanation: The question to increase the number of broken end posts to form combination was carefully considered by your Committee and some of us were against increasing the number of posts to form the combination, whereas the others were in favor of doing so. We would recommend that the above suggestion be discussed in connection with the Committee's recommendation.

Rule No. 107: Recommendation is made that prices for the application of the wooden end sill to the steel underframe cars be reduced from 7 to 4 hours, on account of the lesser labor entailed in framing and applying.

Your Committee concurs in the suggestion that a reduction in price should be made for the wooden filler for steel end sills. In this connection, however, the metal filler for steel end sills should also be considered. Both of these questions on prices should be referred to the Special Committee on Prices.

ADDITIONAL ITEMS.

Page 88—Car Service Rule No. 15: Considerable controversy has arisen at interchange points as to the responsibility for spread cars under load, some roads holding that a spread or leaning car is a receiving road responsibility, whereas others believe cost of transfer on account of spread or leaning cars should be chargeable against the delivering company.

After careful consideration of the intent and meaning of Car Service Rule 15, it is recommended that a note of explanation be added at the bottom of page 88, reading as follows:

> (a) When a loaded car is offered in interchange and the car is spread or out of line to exceed the clearance dimensions of the receiving road, but the condition of the car is such that it is safe to be handled to destination, except that owing to its being spread or out of line the car exceeds the clearance dimensions, the cost of transfer is chargeable to the receiving line.
>
> (b) When a loaded car is offered in interchange and the car is spread or out of line, whether exceeding clearance dimensions or not, and the car is considered unsafe for movement on account of being spread or out of line, the cost of transfer or readjustment of lading is chargeable to the delivering line.

The report of the Committee was passed upon section by section, without discussion, except as follows:

Rule 2:

MR. G. C. WALTHER: I would like to ask whether the Committee considered that under these recommendation that we might be obliged to take from connecting lines or from industrial roads, loads that exceed our clearance limits. According to the present rules, Rule 6 of the rules governing the loading of materials provides that the loads have to come within the clearance limits of the road over which it has to travel. According to these recommendations, we would have to take every load. I do not know what experience we have had with a condition of this kind, but we would probably get up against a load that we could not adjust.

MR. R. L. KLEINE: I would like to say that under the rules as at present, all loaded cars should be accepted. The only change that the proposed rule will make in practice is this: At the present time the rules say you may return loads on open cars to the delivering line for adjustment, and in many cases the interchange agreements provide that the load must be accepted and adjusted by the receiving line, charging the delivering line for the cost of transfer where the load is not in accordance with M. C. B. rules. The loading rules, paragraph 6, require that the height and width of lading shall be governed by the clearance limits of the roads over which the lading is to pass. Of course, if a load is too high or too wide to go over an individual road, the only thing to do is to hold it up irrespective of these rules. You can not pass a load over a road beyond its clearance limits. But if that load can be brought within clearance limits, then, of course, it might be adjusted by the receiving line.

MR. WALTHER: If you get a load like a locomotive loaded on a flat car or large piece of machinery, it would be up to the receiving road to take care of it, according to my understanding of the recommendations just read.

MR. KLEINE: Might I ask what you do under the present rule?

MR. WALTHER: We reject it.

MR. KLEINE: What does the delivering road do?

MR. WALTHER: They have to take care of it. At present the delivering line would protect itself against a load of this kind and if the load exceeded the clearance limits over the route which it had to travel, they will not accept it. If the rule is changed as recommended, the receiving road would have to take care of it, so far as the clearance limits are concerned.

MR. KLEINE: The proposed rule makes no change in Rule No. 6 of the loading rules. In any event, the high and wide load, which cannot be adjusted, would have to be returned, even under these rules, if it can not be passed over the road on account of clearance.

MR. WALTHER: If that is the understanding, I am satisfied.

MR. KLEINE: That is governed by Rule No. 6 of the loading rules, which is part of the interchange rules.

MR. WALTHER: The only point I wanted to make is that if some industrial road would offer us a load, we would be compelled to accept that load and take care of it.

MR. KLEINE: You Rule No. 6 still governs.

MR. WALTHER: And we reject the load under Rule 6?

MR. KLEINE: You would have to reject the load under Rule 6. I might explain a little further that the intention of this Rule No. 2 was this: At the present time the load must be adjusted by the delivering road and the cars returned for such adjustment. The change proposed in Rule No. 2 was intended to provide for the receiving road to adjust the load and charge it back to the delivering road under A. R. A. Rule 15, and it does not contemplate accepting a load too high or too wide for the road to carry. That would be a physical impossibility.

MR. A. M. ORR: There is one question about that from the accounting standpoint: "Add a new paragraph to Paragraph 5 to read, "A. C. T. check is to be used to authorize the transfer." I suppose that means Conducting Transportation?

MR. KLEINE: Yes, sir.

MR. ORR: And is that to be handled through the agent?

MR. KLEINE: Through the agent. That is the next rule. I have not read that rule. I might explain that some roads today are using a blank of this kind; other roads are handling it on a defect card, and across the face of the defect card is written in red ink: "C. T. Check." The idea is to give the delivering road some check on the authorization of the transfer and the per diem involved. The charge for transferring the lading is a C. T. account and not a repair account; therefore, it should be placed upon a C. T. check so that it can be readily distinguished from an ordinary defect card.

MR. ORR: Is it the intention to have the inspector consult the agent?

MR. KLEINE: The inspectors would work in conjunction with the agent and make the authorization.

MR. ORR: Would that interfere in any way with the A. R. A. rules on the matter? They may make some changes in the rules.

MR. KLEINE: I can not see that it would. It is more a matter of accounting and checking up per diem. At the present time, if you use a defect card the agent has no way to check up the matter. In some cases it is a receiving road charge and in other cases it is a delivering road charge. Therefore, the agent or yard master in charge should have some check on it, and a C. T. check can be used to better advantage for that purpose than a defect card.

MR. ORR: The question in my mind was whether, if we got it into the M. C. B. rules some agents would not have a tendency to crawl out of the whole thing. Perhaps it should more properly appear in Instructions for Lading rather than in Instructions for Car Equipment.

MR. KLEINE: The matter is now covered in the interchange rules.

MR. KLEINE: We have another recommendation, the intention of which is to place a time limit on the repairs, and 24 hours are specified as the time limit within which the repairs can be made, under which conditions the load should not be transferred. The committee does not feel that a time limit is the proper thing, although some roads are now transferring loads from cars which could be repaired without transfer. It is essential to avoid transfer of lading as much as possible, but we do not believe the recommendation as made would do it. The rule is now working out very nicely and the Committee thought that they could take the matter under advisement for another year and bring in a recommendation on that particular point.

,Rules 10 and 98:

MR. A. STUCKI: If I understand the matter, the gauge shown in exhibit "B" should be corrected?

MR. KLEINE: I should have made an explanation in regard to one view shown in Exhibit "B." A mistake was made in the enlargement for cut. The graduations at point H were moved up too high and should be dropped down so they will show 1-16 inch. It will be corrected in the final report.

I might say that this gauge is intended to be used not by the ordinary car inspector but by the wheel inspector on the repair tracks for the interchange of steel wheels under cars. At the present time you remove a steel wheel with a certain tire thickness; it is necessary to determine just what thickness of tread wear you have on that tire after removal and also how much you will have left after turning the tire down; the difference between the two is the amount of loss of service metal of the tire, and as you charge for that difference at the rate of 75c per 1-16" it is very convenient to have a gauge that will determine accurately the thickness of the tire and not simply leave it to the judgment of the shop man. You lose too much service material that way. The gauge will also serve a purpose as a shop gauge. You can gauge any type of wheel you have in the shop before your turn it and you know exactly what thickness of tread you should have after turning. Therefore, if the man at the lathe takes off too much of the material from the tread you can readily check him up with that gauge.

Rule No. 12:

MR. ORR: The difficulty would be that about half of those cards would be lost from the cars, and from experience in that line it takes from three months to two years to locate the road that makes the wrong repairs, and the correspondence to locate those repairs would be delayed just that time between the time the car is inspected and put in the shop. If you could change that to make it that cards should be made in duplicate, one copy to be put on the car to show that it has been reported, and one copy sent to the office, the correspondence could be started and the car would carry the evidence of the duplicate card showing that it has already had a joint evidence inspection.

MR. KLEINE: That feature of it was discussed at our meetings and probably most roads would desire to have a copy of the joint evidence card sent to the office. The purpose of the card is, of course, more from a shop than an office standpoint, and the idea of getting the joint evidence card on the car was that when the car reaches the shop the shop making the repairs will have the joint evidence card to send on to the office. There is, however, always the danger of the joint evidence card being lost from the car, and, if desired, it can be made in duplicate. We can revise the rule so that it shall be made in duplicate, but we thought that was more a local condition rather than a rule, because any road can have a copy of the joint evidence card sent to the office if they want it. The reason for the recommendation was largely this, that very frequently joint evidence cards have been made out after the car has gone past the interchange point, and these cards, furnished three or four months later, simply from the record of the car and made out by one inspector instead of the representative inspectors. There is a two-fold purpose in the recommendation. First: That the joint evidence card be made out at the time the car is interchanged; and, secondly: That the joint evidence card be on the car when it comes in for repairs, which will settle the question once and for all. But I see no objection to the suggestion to have the card made in duplicate, one attached to the car and the other turned over to the office.

MR. C. L. COURSON: Would the joint evidence card to be attached to the car be made of card-board? The rules do not provide for any specific kind of card-board. It seems to me we can not put it on the car unless we get it of heavy card-board.

MR. KLEINE: I think the joint evidence card should be made the same as repair cards, the card-board to be attached to the car and the leaflet retained for record.

Rule No. 20:

MR. KLEINE: I might add that it has been general practice to measure the center line of the coupler at the shank. The Interstate Commerce inspectors measure the coupler at the head instead of the shank. Whenever the coupler droops there is a difference in measurement at the shank and at the head. The rule has been changed so that both shall measure at the same place.

PRESIDENT: Gentlemen, you have heard the reading of the recommendations of our Committee. What is your pleasure?

ON MOTION of Mr. F. H. Stark, seconded by Mr. D. M. Howe, and carried by unanimous vote, the recommendations of the Committee are adopted as read.

MR. F. H. STARK: I believe the chairman has one or two questions that have been submitted for consideration. In view of the fact that the hour is not late, I suggest that he present the questions and that there be a free discussion on them.

MR. KLEINE: Referring to page 88, A. R. A. Car Service Rule 15, there seems to be a difference of opinion between inspectors at interchange points as to who is responsible for spread cars.

As an example, take certain box cars which were originally built to pass the clearances of the roads in general. After they become old they get out of line, some of them leaning over. In that case it is a question whether the receiving or delivering road should pay for the cost of transfer. The matter is not handled alike at any two interchange points. I would like to hear from some of the interchange inspectors as to how they believe the matter should be handled.

MR. WALTHER: If the spreading of the car was primarily caused by a defect in the equipment, I would feel that it should be handled as defective equipment, rather than a car exceeding the clearance limits.

MR. KLEINE: I believe Mr. J. L. Stark, of Toledo interchange, is here, and we would like to hear from him.

MR. J. L. STARK: I am with the Hocking Valley Railroad and that includes Toledo. The question brought before us, namely, the interchange of cars with spread sides, is an interesting one, and yet it would appear that the rules govern the matter thoroughly, particularly paragraph D of A. R. A. Rule 15, which holds the delivering line responsible for cost of transfer or rearrangement when cars exceed load limit or cannot pass clearance, or be moved through on account of any other disability of receiving line. The word "cars" covers both closed and open cars and lading. The cases that have come under my observation have to do with cars with sides only very slightly spread and where we find perhaps one road out of the many in a certain territory that will be unable to receive or move forward such cars because of some such disability on their part. It would appear to me in a case like that, that the receiving road should be held responsible just as the rule indicates, and as I think the A. R. A. intended, and we are governed accordingly at all points where I am interested. It is a question, however, which will permit of thorough discussion here tonight.

While I have the floor, and while we are discussing M. C. B. rules, I wish it were possible for this Railway Club of Pittsburgh to adopt a strong set of resolutions to the effect that now we have a set of rules that seem to be satisfactory throughout the country, that railroad companies be urged to live up to them strictly and to the letter. This is a matter that is being discussed throughout the country, but we find certain points that believe it is to their interest to have some special agreements to govern the handling of cars between one road and another in their special locality. This does not appear fair to other railroads in other sections of the country, and it seems to me that the M. C. B. at their coming session should say that the M. C. B. rules as agreed to should be lived up to strictly and to the letter in all parts of the country.

MR. KLEINE: I want to concur in what Mr. Stark says in regard to living up to M. C. B. rules of interchange generally. I do not know of a road that has membership in this Club that does not interchange their cars strictly in accordance with M. C. B. rules of interchange. Therefore, I think we are in a proper position to place ourselves on record very forcibly.

I might ask Mr. Stark a question. Do you feel that the cost of transfer under the rules should be charged to the receiving road in all cases of cars spreading? It is a well known fact that there are a number of old cars in service and when they are loaded, especially with lumber, and loaded high, they will lean over as much as 7 or 8 inches. I would like to ask whether, under those conditions, the receiving road should bear the cost of transferring such a defective car?

MR. STARK: I am ready to say that in a case of that kind, assuming that a car is spread to that extent on one side, it would, in my opinion, be a defective car, and, of course, would not be safe for movement over a road that might have very narrow tunnels and perhaps not safe on any road. You can have a car spread as much as 4 inches, 2 inches on each side, and while it would be noticeable, yet would not be in a dangerous condition. Take cars in the neighborhood of 9′ 8″ or 9′ 10″ when they are built, and a spread of 2 inches on a side does not appear to be a serious matter, and I do not think should be considered such. If cars of that kind can be operated on most any road in the country, and then you find an occasional road that cannot handle them because of narrow tunnels, I do not think that the delivering line should be held responsible. I believe the receiving line that is unfortunate enough to have the very narrow tunnels should be held responsible, according to A. R. A. Rule 15.

MR. SAMUEL LYNN: In that connection I would like to know what there is to prevent an inspector of a receiving line finding some slight defect and refusing the car and having it sent back to be transferred. I have heard of one case where there was a car that did exceed the clearance and the sides were not spread, but the inspector managed to find a defect and he ordered the car transferred, and it went back to the delivering line and was loaded when it got back, no repairs having been made.

MR. O. J. PARKS: Concerning the spreading of the cars it would seem to me that in case a car spread to the extent of being too wide for the clearance dimensions of any railroad, it would be then in an unsafe condition. Because of the spreading of the sides of the car, we lose the carrying capacity of that car as supported by the side board, and I consider that a car spread to the extent of non-clearance would be unsafe, and it should be left to the receiving line to judge.

MR. F. H. STARK: This is rather a deep subject. It reminds one of the question as to which is the mother of a chicken, the hen that lays the egg or the one that hatches it. For an inspector to define just when the spreading of a side or both sides should be considered a defect is a pretty difficult matter. If the receiving line has a tunnel and other clearance sufficient to handle the maximum box cars in service and a gondola is delivered with sides spread exceeding that of a large car, it would seem to me that the delivering line might be responsible. But if the car os not spread beyond the limits of a large box car and the sides are not at an angle which would weaken the carrying capacity of the car, it would appear to me that the receiving line ought to receive the car without question. A question arises there as to who is going to draw the line; it is quite a difficult matter and is worthy of the consideration of this Club.

MR. KLEINE: I would like to make a motion along this line. First, a loaded car offered in interchange and the car is out of line so as to interfere with clearance dimensions and the condition of the car is such that the inspector considers it safe to be handled to destination, although it is out of line to exceed clearance dimensions, the car should be transferred at the expense of the receiving company. And, second, if a loaded car is offered in interchange, whether out of line exceeding clearance dimensions or not, is in such defective condition as to be considered unsafe to run by the receiving inspector, the car must be transferred at the expense of the delivering company.

MR. LYNN: I would ask that this be considered part of Rule No. 2 of the Arbitration Committee.

MR. KLEINE: I would suggest that this be referred to the Arbitration Committee in connection with Rule No. 2.

MR. LYNN: I would second Mr. Kleine's motion.

MR. J. L. STARK: I would like to ask if Mr. Kleine would include in that motion where he uses the word transfer he would also add to it transfer or readjust?

MR. KLEINE: Yes, sir; if that is agreeable to Mr. Lynn.

MR. C. E. BOYER: If the second part of the motion made by Mr. Kleaine has the clause in it that the car is unsafe to move, would it be proper to readjust the lading of that car?

MR. J. L. STARK: That is a very proper question.

MR. F. H. STARK: It might be unsafe to move on account of the spread side, but it would be safe after readjustment.

MR. BOYER: But would not that bring in a car repair question? You would have to repair the car in connection with the readjustment.

MR. KLEINE: I might say that, in accepting the suggestion, that is done at the present time where the superstructure is weak and the car gets over to the extent that it is unsafe to move, they readjust the lading and put braces in the car so as to hold it in condition to go to destination.

The motion to approve the recommendation was carried.

MR. KLEINE: I have one more question, and that is this: While considering the changes in the rules of interchange a case came up as to who should pay the freight charges on materials ordered from foreign roads for repairs. Upon looking into the matter, we find a decision of the Interstate Commerce Commission rendered on that subject, No. 333, company material: "Material for use in the repair of one of its cars was shipped by a carrier to the shop of a connecting line. Upon inquiry as to whether the material should move free of charge over both roads, it was held that in cases of this kind company material may move without charge only over the line at whose expense the repair is made." That would definitely settle the question as to freight charges, and as I construe it, it is this. Say, for instance, the P. & L. E. is making repairs to a P. R. R. car and it is an owner's defect. They order material from the P. R. R. for these repairs. The P. R. R. ships that material to the P. & L. E. and the P. R. R. may ship it free of freight charges over their own line, but would have to pay freight charges over the P. & L. E. If that same car is being repaired by the P. & L. E. and they damage it and are responsible for the repairs, the P. R. R. would charge the P. & L. E. freight charges over their line, and the P. & L. E. would move it free over the P. & L. E. line. That is simply an explanation. It might save considerable correspondence if when asking for the material it would be noted on the request or material card that the repairs are owner's defect or the repairs are delivering line defects. Then the road forwarding the material would know how to adjust the freight charges.

MR. WALTHER: Don't you think it would be advisable to incorporate that in the rule, insisting on the road showing that on the request for the material?

MR. KLEINE: It will require a change in Rule 122, but as the law is effective when issued, no doubt the Arbitration

Committee will issue a circular on the matter, and I simply mentioned it here so that it will avoid delays in furnishing material. Rule 122, of course, will have to be changed to conform with that decision of the Interstate Commerce Commission.

PRESIDENT: It is not up to us, then, to add the matter to our recommendations. Are there any other remarks?

MR. A. G. MITCHELL: I move that the thanks of this Club be given to the very efficient Committee on Revision of M. C. B. Rules of Interchange for their very able report as presented to us this evening.

The motion was duly seconded and carried unanimously by a rising vote.

There being no further business,

ON MOTION, Adjourned at 9:45.

ESTABLISHED 1891

EDWARD KERR, President

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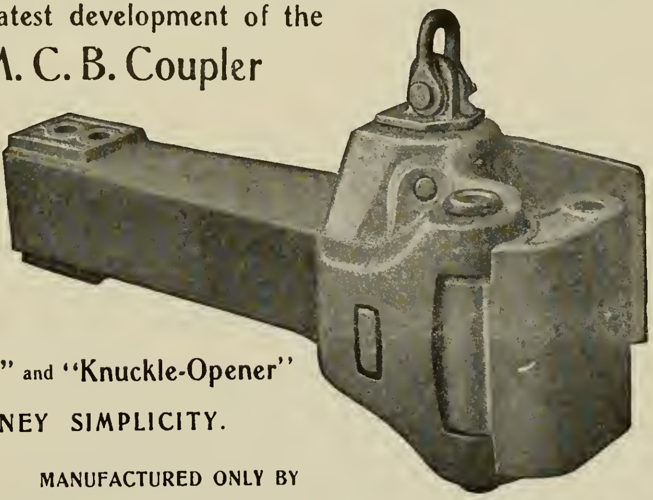

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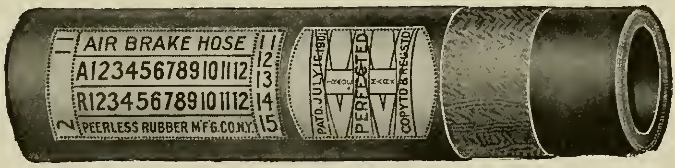

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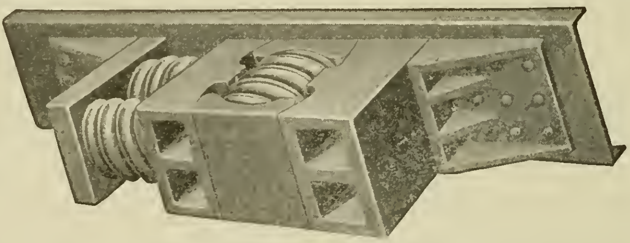

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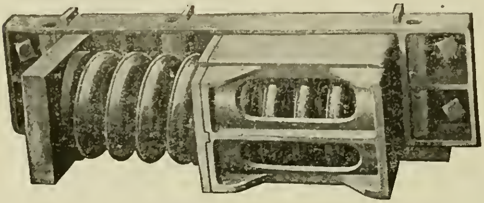

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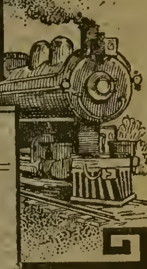

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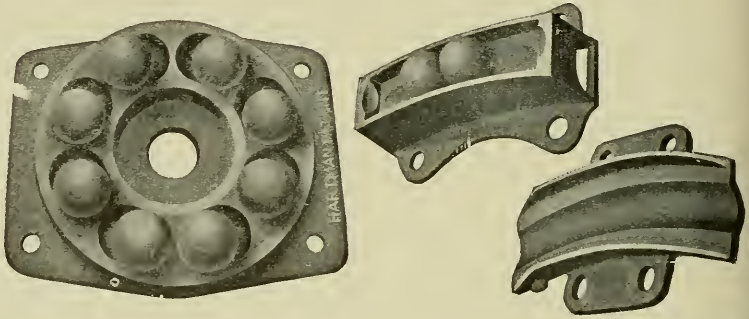

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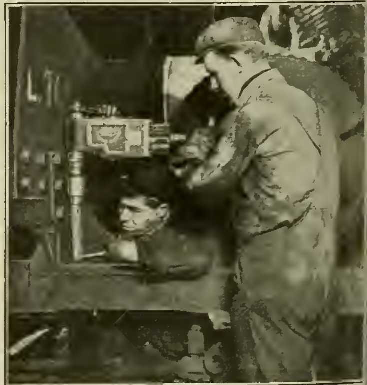

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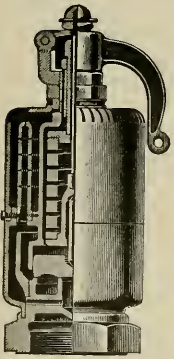

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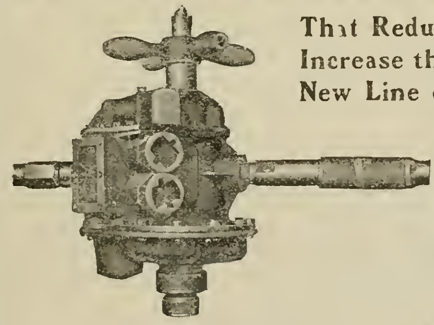

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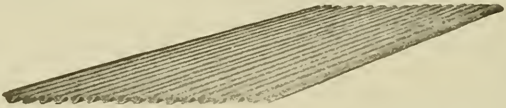

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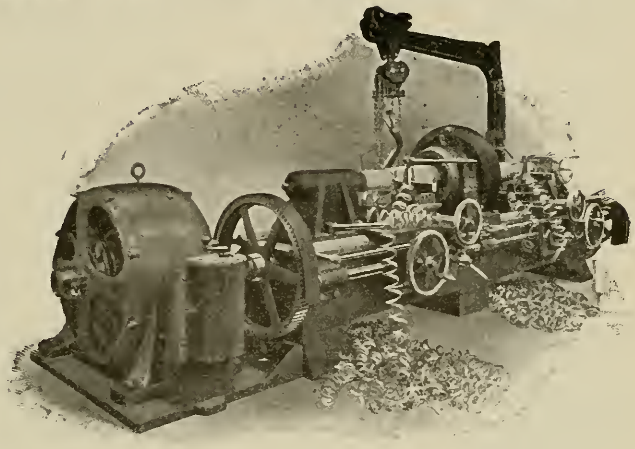

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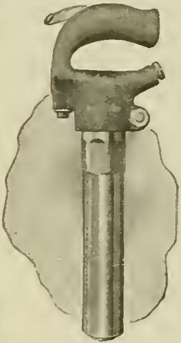

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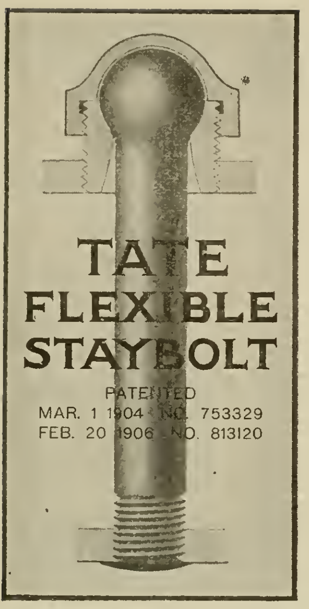

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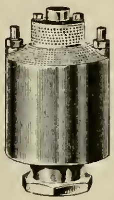

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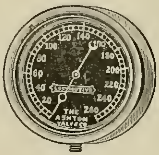
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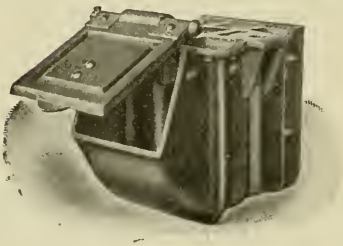

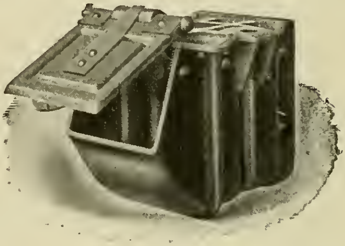

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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING,
APRIL 26th, 1912.

The regular monthly meeting of The Railway Club of Pittsburgh was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., by President F. R. McFeatters.

The following gentlemen registered:

MEMBERS.

Alleman, C. W.
Allison, John
Anderson, J. B.
Amsbary, D. H.
Barth, J. W.
Bealor, B. G.
Blackall, R. H.
Chittenden, A. D.
Clark, D. G.
Cline, W. A.
Coulter, A. F.
Croft, E. P.
Crouch, A. W.
DeLaney, V. W.
Dobson, O. C.
Dress, Geo. M.
Fitzgerald, D. W.
Froelich, J. H.
Gilg, H. F.
Guthrie, J. B.
Harriman, H. A.
Haynes, J. E.
Hench, N. M.
Herlehy, T. W.
Herrold, A. E.
Higgins, H. L.
Hilty, H. A.
Howe, D. M.
Howe, H.
Hurley, Theo.
Johnson, W. A.
Jordan, J. E.
Kelly, H. B.
Kinch, L. E.
King, Wm. R.
Kurzhals, C. L.
Lewis, D. R.
Lobez, P. L.
Lynn, Samuel
Mackert, A. A.
Malloy, M. A.
Mensch, E. M.
Millar, C. W.
Milliken, I. H.
Mitchell, A. G.
McFeatters, F. R.
McKeon, R. D.
McNaight, A. H.
McNulty, F. M.
Orchard, Chas.
Orner, M. T. S.
Pechstein, A. J. G.
Porter, C. D.
Proven, John
Redding, D. J.
Richardson, S. W.
Rupp, R. D.
Ryan, Wm. F.
Sampson, J. M.
Schiller, John
Schomberg, W. T.
Sharpley, H. G.
Shook, A. A.
Shumaker, F. S.
Smith, Russell
Smith, C. E.
Stafford, S. G.
Stark, F. H.
Stucki, A.
Sullivan, W. H.
Taylor, F. C.
Thomas, P. L.
Voight, A. J
Waddell, F. W.
Walther, G. C.
White, F. L.
White, J. D.
Wood, Ralph C.

VISITORS.

Anderson, H. A.
Brock, R. E.
Brosius, E. E.
Brophy, E. J.
Brophy, Jas. J.
Burns, J. D.

Burrell, H. B.
Clark, A. F.
Deagen, J. J.
Emmett, W. A.
Freed, G. F.
Freeman, A.
Frye, H. B., Jr.
Gant, Edward
Guthrie, B.
Hindman, J. E.
Keenan, C. R.
Lonebubeck, H. C.
Newell, E. W.
North, Fred
Obermeier, H.
Parker, J. H.
Ross, C. B.
Shapleigh, S. C.
Sullivan, W. B.
Thompson, F. P.
Wickerham, F. A.
Wikstrom, M.

The minutes of the last meeting having been published, the reading of them was dispensed with.

The Secretary read the following list of applications for membership:

Barnes, P. H., General Car Foreman, B. & O. R. R., Zanesville, Ohio. Proposed by M. O'Connor.

Brown, Guy B., Agent, B. & L. E. R. R., 1422 Coal St., Wilkinsburg, Pa. Proposed by J. M. Warfield.

Casterline, C., Agent, Penna. R. R., Etna, Pa. Proposed by E. M. Craig.

Flaherty, T. K., Road Foreman of Engines, B. & O. R. R., Grafton, W. Va. Proposed by A. W. Crouch.

Finley, George F., Wreck Master, Penna. R. R., Youngwood, Pa. Proposed by B. Kopferschmidt.

Hastie, J. W., M. W. & S. Dept., Penna. R. R., Freeport, Pa. Proposed by E. M. Craig.

Hutson, H. M., General Foreman, B. & O. R. R., Box 322, Grafton, W. Va. Proposed by A. W. Crouch.

Keiser, John, Passenger Train Master, Penna. R. R., 425 Center St., Wilkinsburg, Pa. Proposed by J. B. Anderson.

Krebs, G. W., Operator, Penna. R. R., Oakmont, Pa. Proposed by E. M. Craig.

Lilliard, T. M., General Foreman, Car Shops, B. & O. R. R., Cumberland, Md. Proposed by M. O'Connor.

Lemon, John, Road Foreman of Engines, B. & O. R. R., 237 Maple Ave., Grafton, W. Va. Proposed by A. W. Crouch.

McCann, J. P., Salesman, Carborundum Co. of Niagara Falls, 459 Frick Annex, Pittsburgh, Pa. Proposed by O. C. Dobson.

Newell, E. W., Engineer, W. A. B. Co., Wilmerding, Pa. Proposed by F. R. McFeatters.

Obermeier, H., Foreman, P. R. R. Co., Box 565, Pitcairn, Pa. Proposed by W. H. Sullivan.

Robinson, L. O., Shipping Clerk; Universal Portland Cement Co., Universal, Pa. Proposed by J. M. Warfield.

Rowland, W. I., Master Mechanic, B. & O. R. R., 479 Maple Ave., Grafton, W. Va. Proposed by A. W. Crouch.

Rupert, J. W., Master Mechanic, B. & O. R. R., No. 58 Mineral St., Keyser, W. Va. Proposed by M. O'Connor.

PRESIDENT: As soon as these applications have been favorably passed upon by the Executive Committee the gentlemen will be admitted to membership.

SECRETARY: This will raise the membership to 1,008.

The Secretary announced the death of Jas. Kennedy and J. H. McAdoo.

PRESIDENT: I understand the United States Steel Corporation has taken a great interest in the matter of safe-guarding machinery, etc., and have spent over $750,000 on safety guards alone. Mr. Close, who has charge of that department in New York, has written me a letter in regard to a matter which I thought this Club might wish to consider and refer to the Master Car Builders' Association. I will ask the Secretary to read the letter.

April 25th, 1912.

Mr. F. R. McFeatters, President, The Railway Club of Pittsburgh

Dear Sir:—The Safety Committee of the United States Steel Corporation have been working for some time to procure a wrench suitable for opening hopper bottom cars that can be recommended to all companies from a safety as well as practical standpoint. A number of designs of these wrenches have been submitted to the Committee by the subsidary companies of the Steel Corporation, and while all of them have been of a very good design they lack a certain feature, inasmuch as they do not take care of the different sizes of square shafts to which the wrench is applied. As I understand it, there is no uniformity of size for these shafts, and at the last meeting of our Committee it was decided to take the matter up with the Master Car Builders'

Association to see if some steps cannot be taken to standardize the size of shaft.

Numerous serious accidents have happened to employees in opening drop bottom cars with the old style wrenches, and the danger is not entirely overcome with the new wrenches that have been designed on account of being unable to use them on different size shafts.

Mr. L. C. Bihler, Traffic Manager of the Carnegie Steel Co., was in the office this morning and he suggested that I take the matter up with you, stating that you are having a meeting of The Railway Club on April 26th, and that it was possible you would bring this matter up for discussion at that time.

Thanking you for your kind consideration of the matter, I am

Yours very truly,

L. C. CLOSE.

MR. D. J. REDDING: I move you that the communication be referred to the Secretary of the Master Car Builders' Association, with the endorsement of this Club, for consideration of the Committee on Standards. Agreed to.

PRESIDENT: If there is no further business, we will proceed with the paper of the evening, "A Study of the Proper Hardening and Classification of Tool Steels," by Mr. W. B. Sullivan, of The Carpenter Steel Company, Reading, Pa.

A STUDY OF THE PROPER HARDENING AND CLASSIFICATION OF TOOL STEELS

BY W. B. SULLIVAN.

The purpose of this paper is to bring to the aid of the mechanical department of railroads, and especially the practical handlers of tool steel, facts that make for a clearer understanding of the treatment of steel and for more uniform results in the service of tools.

In the last few years many valuable facts have been learned through scientific research and by the practical application of this knowledge we have made great progress.

The old method of forging, treating, tempering, and annealing tool steel from some indefinite red or yellow color was, as we know now, much a matter of guess-work. We have learned that certain so-called mineralogical changes take place in steel when heated, and we have now the possibility of determining the points at which these changes occur. We have learned, too, that there are principles involved in the heat-treatment of steel that are fundamental, and that with a sufficient understanding of these principles it is possible to obtain almost any desired results.

When a steel tool or part is to be designed, the first question arising is how much strength will be required to sustain the working condition, and next, what quality and degree of hardness will be required to resist wear. The answer involves the consideration of the following factors:

First—The appropriate grade or quality of steel to be selected for use and its proper carbon content—i. e., that combination of grade and carbon to which by proper heat-treatment, a physical condition can be imparted that will insure the longest wearing service and sufficient strength to sustain the working stresses.

Sceond—The proper temperatures at which that steel should be treated—that is, heated and cooled, and the manner of this treatment.

Third—The manner of determining the proper degree of hardness and toughness for the tool or part.

To work out this problem we must be familiar with the different straight-carbon tool-steels, and such alloy-steels as are made for the particular purpose in view. We must also be able to fix upon a definite method of heat-treatment in order to get the full advantage out of the material selected, and to this end we must have a working knowledge of the so-called "critical points" of the steel—that is, a knowledge of the mineralogical changes which occur when the steel is heated, for through them the proper hardening temperature should be determined. Furthermore, we must appreciate what degree of accuracy is necessary in drawing or tempering the steel to insure uniformity, and this involves the intelligent use of the Shore Soleroscope, the file or other hardness-measuring device.

We will first discuss the straight-carbon tool-steel—its components and the critical points where the mineralogical changes in them take place; the effect of quenching from heats at and about the critical points; the result of tempering or drawing accurately, and the irregularities in the old methods of forging and treating.

The principal components of carbon tool-steel, in its various conditions of hardness, are:

(1) Ferrite, pure iron, which occurs only in annealed tool-steel of approximately 90% carbon or less; it is soft and ductile and cannot be hardened.

(2) Cementite, a carbide of iron, which is hard and brittle and occurs in annealed tool-steel of higher than .90% carbon.

(3) Pearlite, a soft and tough mechanical mixture of ferrite and cementite, forming the chief constituent of annealed tool-steel.

(4) Martensite, a solid solution of iron-carbide in iron, formed by heating tool-steel to a definite high temperature and quickly cooling. It is close grained, but very brittle, and is the chief constituent of hardened steel.

There are several other components representing transition stages between martensite and pearlite, but the four just mentioned are the most characteristic and are of greatest practical interest.

These components, or minerals, so-called, are not distinguishable to the naked eye, but may readily be seen by polishing a section of the steel, subjecting it to the action of an acid or other etching agent which imparts characteristic colors to the different constituents, and then examining the section under a microscope.

By heating carbon tool-steel, say of .90% carbon, to definite high temperatures and then cooling with different degrees of rapidity, we obtain steel that is either annealed, semi-annealed or hardened. The different temperature-points at which the changes within the steel take place that result in good annealing or good hardening are called its critical points.

These critical points have usually been sought by cut-and-dry methods, but now they are far more accurately determined by means of a critical-point instrument, in which advantage is taken of the fact that when the mineralogical changes occur in the steel during heating there is an absorption of sensible heat and when the reverse changes occur on cooling, there is an evolution of sensible heat. Such a determination of critical points is very carefully performed in the laboratory of The Carpenter

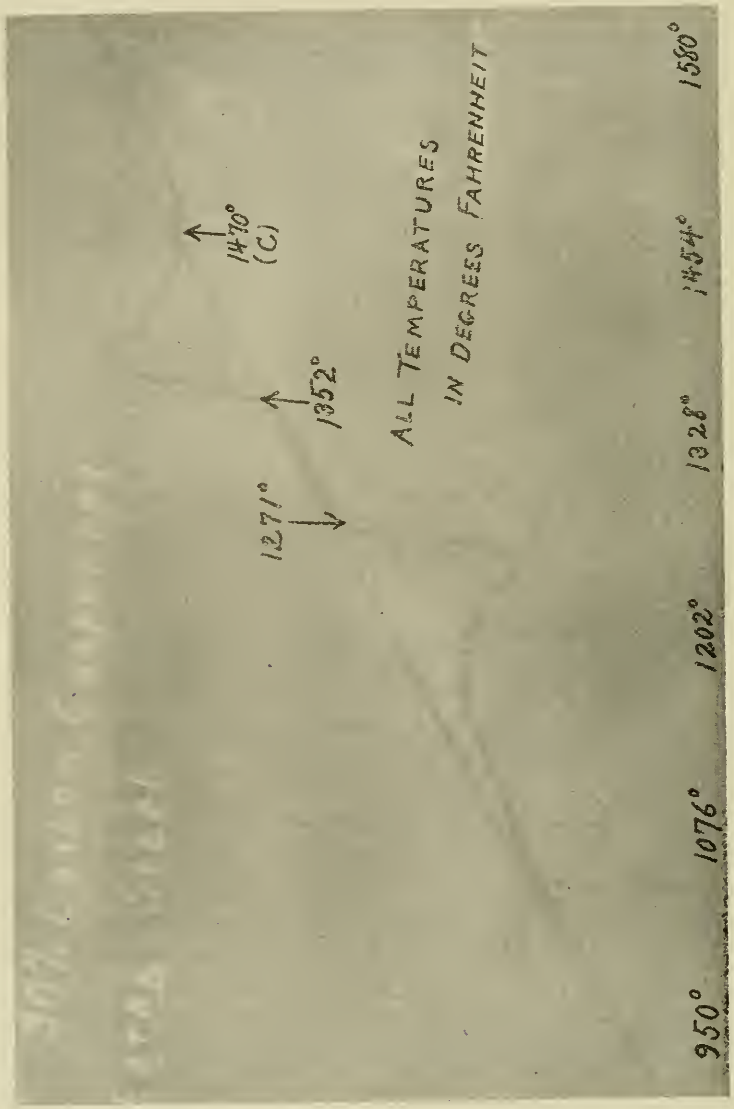

Fig. 1

Steel Company with a Saladin instrument which makes an autographic record on a photographic dry-plate, producing a heating and cooling curve of the character shown in Figure 1.

If we heat a piece of annealed tool-steel in a furnace and follow with a Saladin instrument the curve traced in the process, we shall observe that no change takes place—in other words, that pearlite remains unaltered—until 1352° Fahr. is reached. At this point an offset in the heating-curve is noted: the steel begins to absorb heat as mineralogical changes are started which are not wholly completed until the curve again becomes almost a straight line, when all the pearlite will have been changed to martensite. At this temperature-point the hard constituents in the steel can be fixed if the material is quenched in water or otherwise cooled very quickly. Upon reheating the hardened steel, the contained martensite decomposes readily, the amount of change depending upon the temperature attained. For example at 500° Fahr., a straw color, enough martensite will be decomposed into the softer pearlite to make the steel fairly hard and tough instead of extremely hard and brittle. By further raising the temperature more martensite will be decomposed into pearlite, and finally if the heating be carried to a point just below that at which martensite is formed, namely 1352° Fahr., all the remaining martensite will have been decomposed into pearlite and the steel if slowly cooled from this point will once more be in the condition of soft annealed tool-steel.

The difference in composition of steel heated to different temperatures in and about the critical point and quickly cooled is shown by the accompanying photomicrographs, Figs. 2 to 7 (all photomicrographs are at 550 diameters).

Figure 2 heated to 1328° Fahr. and quenched in water.
Figure 3 heated to 1364° Fahr. and quenched in water.
Figure 4 heated to 1400° Fahr. and quenched in water.
Figure 5 heated to 1436° Fahr. and quenched in water.
Figure 6 heated to 1472° Fahr. and quenched in water.
Figure 7 heated to 1508° Fahr. and quenched in water.

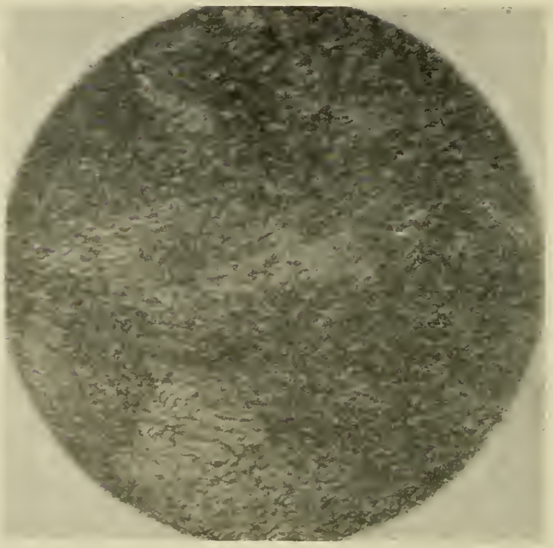

Fig. 2

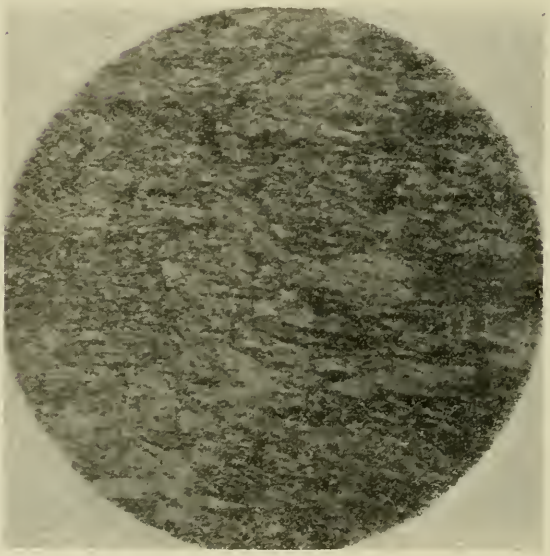

Fig. 3

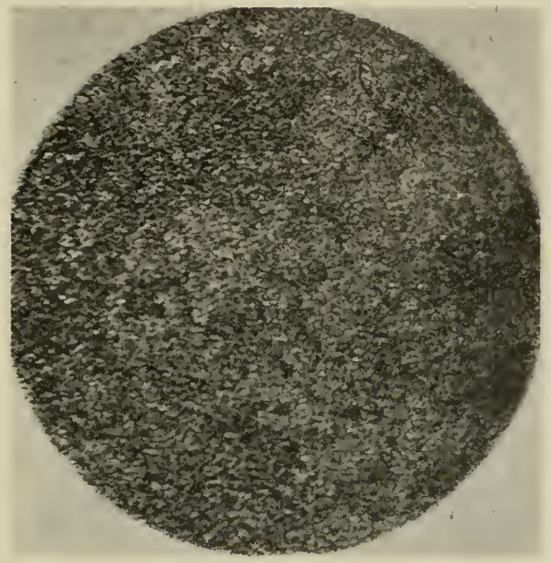

Fig. 4

Fig. 5

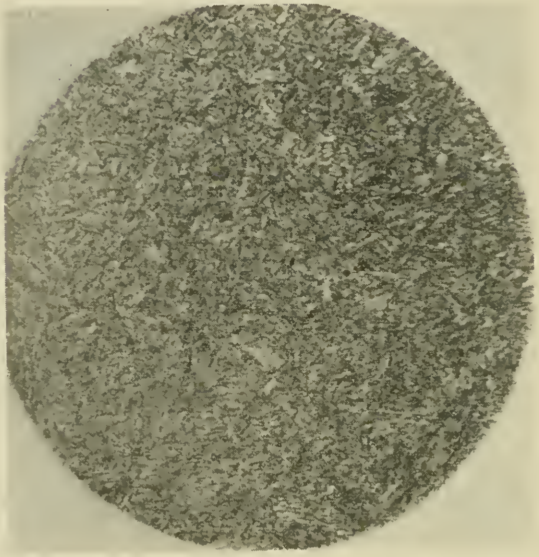

Fig. 6

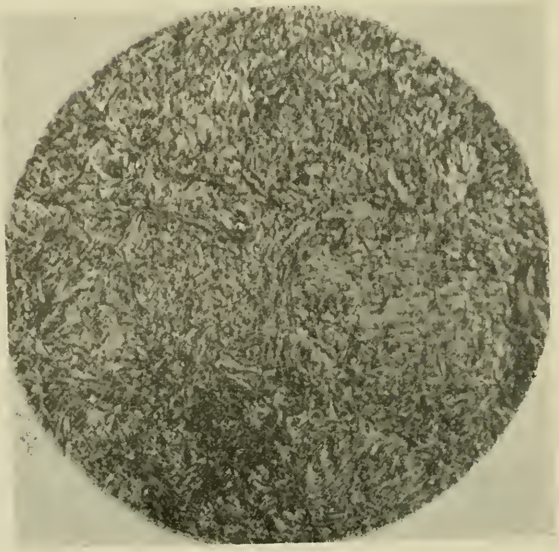

Fig. 7

In these figures you may observe the structure of a 90-carbon tool-steel as obtained by heating to the temperature noted and quenching in water.

Figure 2, quenched from a temperature of 1328° Fahr., shows the structure of an unhardened piece composed of pearlite.

Figure 3, quenched from 1364° Fahr., when the mineralogical change has just commenced, is composed of pearlite and a little martensite.

Figures 4 and 5, quenched respectively from 1400° and 1436° Fahr., show increasing amounts of martensite.

Figure 6, quenched from point C on the curve (Fig. 1), where the mineralogical change has been completed, shows nothing but martensite.

Figure 7, quenched from 1508° Fahr., shows a martensite structure, but observe that the grain size is very much larger, indicating that overheating has begun.

Applying practically this matter of hardening temperatures, we see that a tool should be heated carefully and uniformly to the proper temperature, point C on the curve (Fig. 1), and quenched. It is to be noted that when the complete structure of the steel has been developed the effect of further heat is to produce only a larger coarse-grained mineralization, characteristic of overheating, and surface decarbonization.

Accuracy to size in the days before the micrometer was nothing to speak of, but now it is common practice to work as close as one ten-thousandth (.0001) part of an inch, and we all know that by means of this accuracy of measurement, interchangeable parts have become the rule of the day. Until the comparatively recent general adoption of pyrometers, hardening heats were measured by various shades of red as they appeared to the eye of the hardener, and we are all familiar with the indifferent success of tools hardened by this method. As has been shown by the photomicrographs, steel is easily affected by a few degrees of heat, and if the duplication of the physical condition of any given tool is to be expected, the pyrometer will have to be used as constantly and as carefully in the hardening-room as the micrometer is used in the tool-room.

As you all know, the mere having of a micrometer in the shop does not mean duplicate-sized tools, and merely having a pyrometer in the hardening-room and a scleroscope in the testing-room does not mean close duplication of temperature and hardness. Experience in the use of these instruments, and their constant calibration and use are all-important factors in the production of high-efficiency tools. I cannot emphasize too strongly the importance of constantly checking up, and the daily use of these instruments.

A few words more regarding the pyrometer and a simple method for its calibration. As its name implies, the pyrometer is an instrument for measuring elevated temperature. Of such instruments there are many kinds, but the type usually preferred for the work we are considering is the thermo-electric pyrometer, consisting of a thermo-couple or so-called "fire-end," a volt-meter, and copper wire of low resistance connecting the two. The "fire-end" or thermo-couple has a hot and a cold end, the former projecting into the furnace, while the latter remains outside of it and is usually maintained at room temperature about 20° Centigrade (or 68° Fahrenheit). The difference in temperature between the two ends of the thermo-couple generates an electro-motive force proportional to that difference, and so by connecting the free terminals of the cold end with the volt-meter which is graduated to read directly in degrees Fahrenheit or Centigrade, the furnace temperature may be readily ascertained.

In operating with a pyrometer, the following rules and precautions should be constantly borne in mind.

First—Keep the hot end of the thermo-couple as near the work as possible; do not put it through the furnace wall or roof, exposing the end to the direct heat of the flame, but place it so that it attains, as nearly as possible, the same temperature as the work.

Second—Keep the cold end of the thermo-couple protected or screened by asbestos board from the direct or radiating heat of the furnace. Most base-metal thermo-couples are calibrated with the cold end at about 20° Centigrade (68° Fahrenheit), wherefore this temperature for the cold end should be maintained as closely as practicable.

Third—Protect the volt-meter by a dust-proof case, and place it on a support free from vibration. The location need not be at any great distance from the furnace, yet sufficiently remote to avoid absorbing heat from it.

Fourth—All switches should be of the wiping-knife type. Improper contact at the switches is a prolific source of error, and such errors are not readily located. The electric current generated in the instrument is very feeble, for which reason the introduction into the circuit of even a trifling increase of resistance affects the reading of the volt-meter appreciably.

Fifth—Carefully check all thermo-couples as soon as they are received from the manufacturer and before putting them into service. Adhere closely to this rule, instead of assuming that new thermo-couples are sure to be correct; nor, for the same reason, should new thermo-couples be used in blind faith for checking, since they occasionally show a considerable error, and anyone making use of them as standards will sooner or later come to grief.

Sixth.—Carefully standardize each pyrometer at definitely stated intervals—at least once a week, and as much oftener as possible. Frequent calibration is a matter not of convenience but

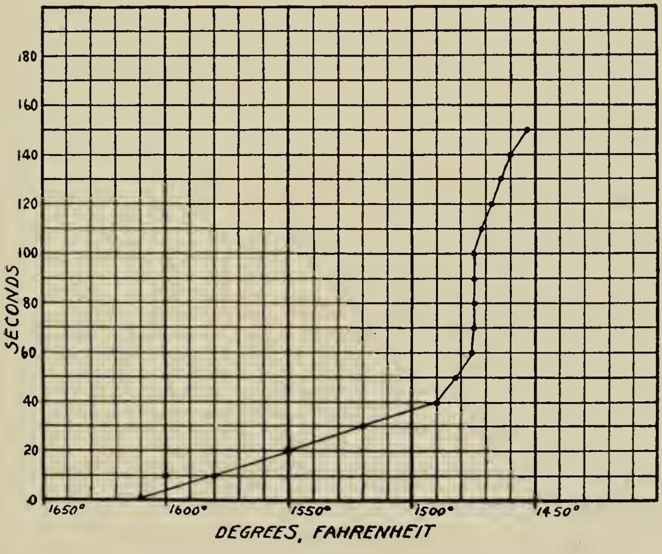

Fig. 8.

Diagram showing the Calibration of a Pyrometer which is correct.

of necessity. Do not imagine that this practice will reduce your production, for, on the contrary, it will increase your output of parts properly heat-treated.

How can the calibration of a pyrometer be accomplished readily and accurately without the use of an extensive laboratory equipment? To this question of immediate interest in every hardeneing-room, I would answer that the easiest and most convenient method is that based upon determining the melting-point of common table salt (sodium chloride). Chemically pure salt, which is neither expensive nor difficult to procure, should be used where accuracy is desired. The salt is melted in a *clean* crucible of fire-clay, iron or nickel, either in a furnace or over a forge fire, and then further heated until a temperature of about 875° to 900° Centigrade (1607 to 1652° Fahrenheit) is attained. It is essential that this crucible be *clean*, because a slight admixture of a foreign substance might noticeably lower or raise the melting point. The thermo-couple to be calibrated is then removed from its protecting tube and its *hot* end is immersed in the salt bath. When this end has reached the temperature of the bath, the crucible is removed from the source of heat and allowed to cool, and while cooling readings are taken every ten seconds on the volt-meter. A curve is then plotted by using time and temperature as co-ordinates, and the temperature of the melting-point of salt, as indicated by this particular thermo-couple, is noted—at the point, namely, where the temperature of the bath remains temporarily constant while the salt is freezing. The length of time during which the temperature is stationary depends on the size of the bath and the rate of cooling, and is not a factor in the calibration. The melting-point of salt is 801° Centigrade (1474° Fahrenheit) and the needed correction for the instrument under observation can be readily applied. The accompanying curves (Figures 8 and 9) illustrate the calibration of a correct and incorrect pyrometer:

A good practice is to make one pyrometer a standard; calibrate it frequently by the melting-point-of-salt method, and each morning check up every pyrometer in the works with the standard, making the necessary corrections to be used for the day's work. By pursuing this course systematically, the improved quality of the product will much more than compensate for the extra work.

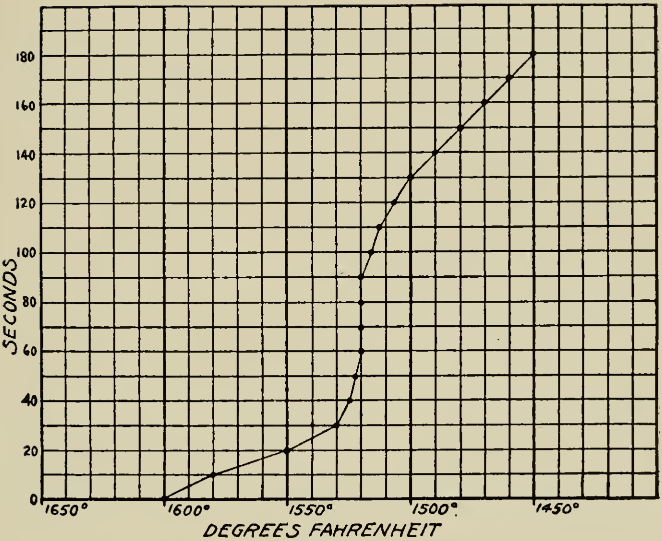

Fig. 9.
Diagram showing the Calibration of a Pyrometer which reads 45 degrees Fahr. too high.

The object of heating tools to definite temperatures and cooling with various degrees of rapidity is to give to them the proper combination of hardness and toughness which will enable them to stand up to their work. In straight-carbon tool-steel the first requisite is hardness, after which the tool may be drawn to get the proper combination with toughness.

The hardness will be governed by the following factors:

1. *Size of Piece*—It is known that for a given material, such as 90-carbon tool-steel, different quenching temperatures must be used for various sections in order to obtain maximum hardness. This is a matter of practical experience for which no hard and fast rule can be laid down, but in a general way it may be said that the smaller the section the lower should be the temperature.

2. *Character of the Material and Carbon Content*—This is a matter to be considered from the nature of the tools and work at hand.

3. *Temperature of the Bath or Cooling Medium*—The degree of hardness of steel quenched from the hardening tempera-

ture, point C on the curve (Fig. 1), depends upon the rapidity with which the heat is drawn from the steel. As a rule, the higher the temperature of the quenching medium, the lower will be the hardness of the steel. For this reason, it is advisable to maintain the temperature of the bath as nearly uniform as possible for a given piece, though for some forms of cutters and dies it will be found expedient to vary this temperature.

4. *Character of the Bath or Cooling Medium*—The cooling medium may consist of water, brine, oil of various kinds, lead, air, etc. As water extracts heat more rapidly than oil, straight-carbon tool-steel quenched in water will be harder than if quenched in oil; quenched in air it will have a certain amount of hardness, but much less than if cooled in oil. Recently an investigation was made in the laboratory of The Carpenter Steel Company to find the relative cooling properties of different kinds of oil compared with water as a standard. The method of determining these values was a follows:

A piece of steel weighing 420 grams was heated to 212° Fahrenheit and cooled in 600 grams of the liquid under investigation, which was at about 70° Fahrenheit. Actual temperature, however, was measured. After immersing the steel the liquid was agitated and a record was taken of the time necessary for the liquid to reach a maximum temperature. This represented the point at which liquid and steel were of the same temperature, or, in other words, when the heat had been abstracted from the steel. The cooling quality of the oil was then determined, using water as unity. The figures given each represent an average of three tests. To properly determine the grade of oil used, specific gravity at 60° Fahrenheit, viscosity at 150° Fahrenheit, and the flash-point were determined.

DETERMINATIONS OF TEMPERING QUALITIES OF OILS,

Kind of Oil	Sp. Grav. 60° F.	Viscosity 150° F.	Flash. °F.	Temp. Qual.
Water	1.000	1.000	....	1.0000
Corn Oil	.921	1.45	512	.1927
Cotton Seed	.918	.....	550	.1606
No. 1 Mineral	.859	1.30	420	.2409
No. 2 Mineral	.872	1.81	440	.1667

No. 10 Mineral	.866	1.27	410	.2304
Novo Superior		.....	....	.1950
Rosin Oil		.....	....	.1350
Fish Oil		.....	....	.1490

A tool properly treated, one that combines hardness and toughness in proper proportion for the work at hand, has a definite hardness-value which can be estimated with a file or measured with a scleroscope, a Brinell machine or by several other less known means. The file-test, perhaps the most popular and the one most widely used today, is being rapidly replaced by the scleroscope on account of its greater definiteness and reliability.

The scleroscope test is based upon the free fall in air of a ball of known weight through a known distance. The ball is fitted with a diamond point which strikes the test-specimen; the rebound of the ball, as indicated on an arbitrary scale, is the measure of the hardness. There are a number of variables, connected with the determination of hardness by this instrument, which must be carefully watched in order to obtain uniform and correct results. In our experience the scleroscope has its greatest application to values on the scale of 75 and over. Due caution must be observed in analyzing and comparing the results obtained with it for different materials, since each material seems to yield hardness-values characteristic of that particular material, without any definite relation to the hardness-values obtained for other materials.

The Brinell test is based upon sinking a ten-millimeter hard steel ball into the object or specimen to be tested by applying a load of 3000 kilograms, and the volume of the impression, as found by measuring its diameter and expressed in terms of an arbitrary scale, is the measure of hardness. Often this instrument cannot be used on finished surfaces as it leaves a permanent indentation. Its greatest application is found in values of 475 or less on the Brinell scale.

Attempts have been made to establish a factor for changing Brinell hardness-values into scleroscope values, but our experience has been that different factors will have to be used for each grade of material, and different factors even for the same grade when the material is hardened in oil and in water.

In working out a new tool problem or in finding a solution for some tool trouble, the correct way to proceed should be, after selecting the proper steel, to harden three or four tools of the same kind and to determine the hardness-value of each, which should be uniform. The tools should then be drawn at various definite temperatures to obtain hardness-values covering a considerable range above and below the value that experience suggests as being about the proper one for the work—say at 450°, 500°, 550° and 600° Fahr., and the hardness-value should be definitely determined for each. If a record is kept of the hardening and drawing temperatures, the hardness-values, the work performed and the reason for failure or success of each tool, the tool-maker will soon be in a position to determine the proper condition of the tool for the given work, and to duplicate that condition very closely without any trouble whatever.

As an example of how this works out, I will cite a recent experience with a die block making an unusually hard forging. The die was hardened and drawn to show a scleroscope hardness of 75; it made 66 forgings when it failed by cracking. Another block of exactly the same grade of material was hardened and drawn to show a scleroscope value of 70 when it made 600 forgings and failed in the same manner as the first block. A third block of the same material was hardened and drawn to show a scleroscope value of 65 and this block was in splendid condition after making 13 000 forgings.

While all that has been said is general in character, I have so far referred only to the application of these modern hardening-room methods to straight-carbon tool-steel. To illustrate their application also to high-speed steel I am offering some photomicrographs which show conclusively that if more accurate temperatures were used and the hardening-range held within narrower limits, better results might be obtained from the use of high-speed steel. The photomicrographs are all taken at 550 diameters.

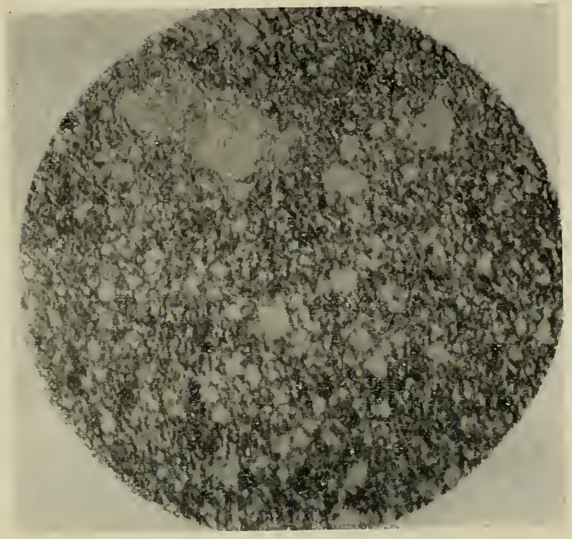

Fig. 10

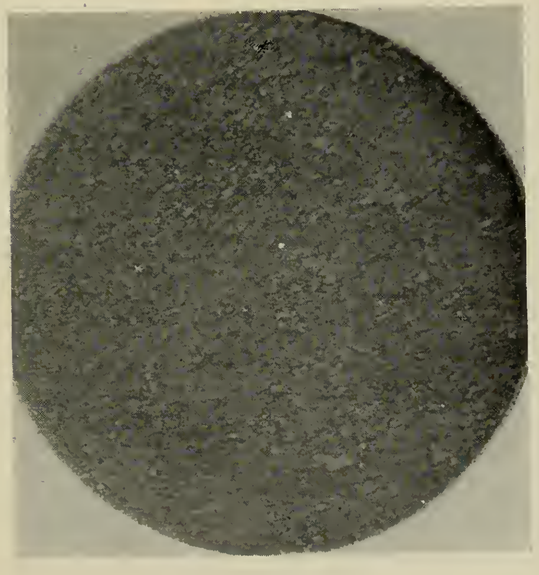

Fig. 11

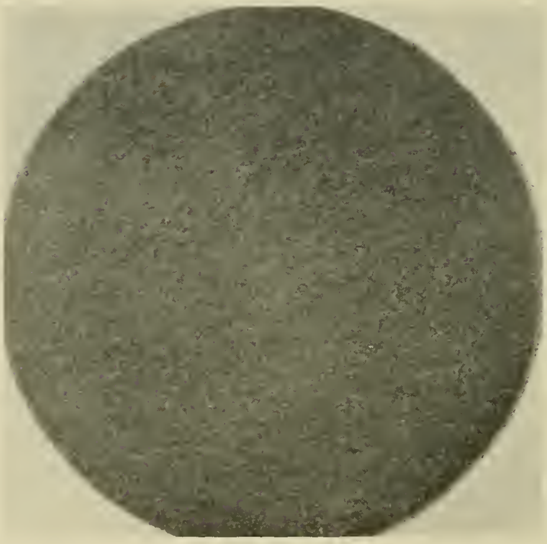

Fig. 12

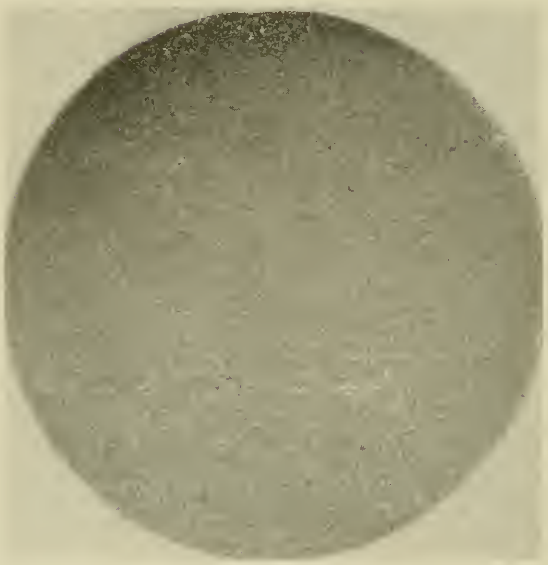

Fig. 13

Fig. 14

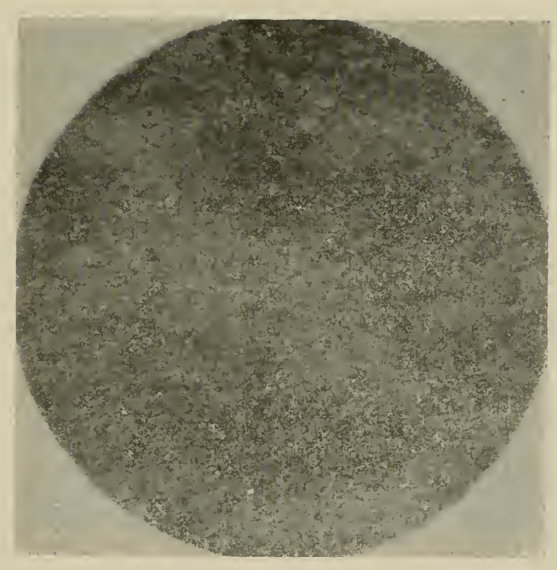

Fig. 15

Fig. 16

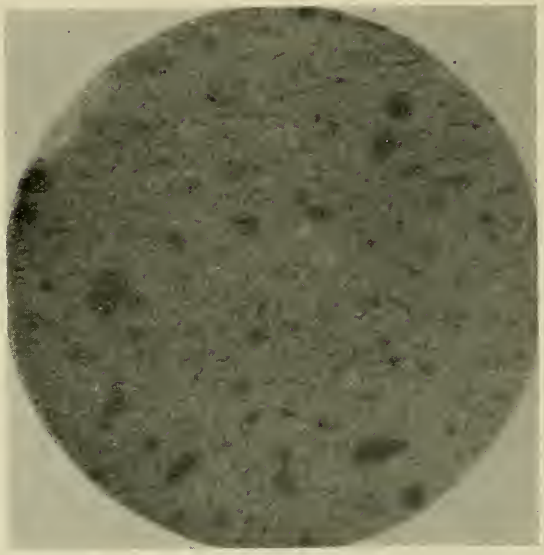

Fig. 17

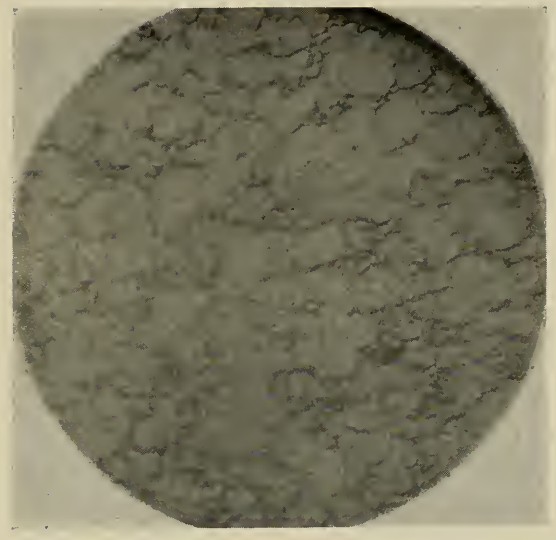

Fig. 18.

Figure 10 shows the structure of annealed high-speed steel, and Figure 11 show its structure when quenched in oil from 2000° F.

Figure 12 shows the structure of the same material when quenched in oil from 2050° F.

Figure 13, the structure when quenched in oil from 2100° F.
Figure 14, the structure when quenched in oil from 2150° F.
Figure 15, the structure when quenched in oil from 2200° F.
Figure 16, the structure when quenched in oil from 2250° F.
Figure 17, the structure when quenched in oil from 2300° F.
Figure 18, the structure when quenched in oil from 2350° F.

You will notice that from Figures 11 to 15 there is a progressive change marked by a breaking up of the large white areas that are so pronounced in Figure 10 and that when Figure 15 is reached, representing the structure at 2200° F., there is a decided alteration in the character of the steel, which change is completed in Figure 16, representing the structure at 2250° F. The changes which have been gradually taking place are completed in Figure 16, and we have in that the ideal condition for high-speed steel.

Figures 17 and 18 show a much larger grain growth and while the cutting properties are not materially affected at this temperature, the steel is much more brittle and also has a tendency to crumble on the cutting-edges.

Some drilling-tests representing actual service of tools hardened from some of these temperatures are noted below, and special attention is called to the remarkable difference in service obtained by hardening tools from temperatures just 50° F. apart. The size of the drills was 5/8"; speed, 245 revolutions per minute; feed, 2" per minute; thickness of plate tested, 1/2"; material tested, half-annealed 1.0% carbon tool-steel.

Drills hardened from 2050° F., Fig. 12, averaged 1½ holes.

Drills hardened from 2150° F., Fig. 14, averaged 7 holes.

Drills hardened from 2200° F., Fig. 15, averaged 31 holes.

Drills hardened from 2250° F., Fig. 16, averaged 95 holes.

It is to be noted that these service-tests check up very closely the photomicrographs, which show the critical range of high-speed steel, and they illustrate conclusively how closely hardening temperatures should be observed in order to get maximum efficiency from the tools.

In addition to straight-carbon steels and high-speed steels there are other important special-service alloy steels, for which the proper hardening and treating temperatures are arrived at in the same way, by the use of the critical-point instrument and the microscope.

In fact, the handling of tool-steel, taken in its broadest sense, is no longer a matter of estimating heat-colors—at its best a method depending very largely on the personal skill and training of the tool-dresser—but it follows definite lines that are scientifically worked out. The equipment that is necessary for the newer method is simple and easily operated if a little care is exercised, and its use need not in any way increase the cost of the finished tool; the increase in efficiency from the tool properly hardened can hardly be approximated.

As a result of some years' experience and study of the subject of straight-carbon tool-steel, there is appended a classification of this type of material giving grade, carbon content, purpose, and also forging, hardening and annealing temperatures.

GRADE OR QUALITY.

Carbon tool-steels may be classified under four grades, A, B, C, D.

TEMPER NUMBERS OF CARBON CONTENT.

There may be five temper numbers, 1, 2, 3, 4, 5.

TEMPER NUMBERS AND THEIR VALUE.

No. 1 shall contain .70 to .80 per cent of carbon.
No. 2 shall contain .80 to .90 per cent of carbon.
No. 3 shall contain .90 to 1.00 per cent of carbon.
No. 4 shall contain 1.00 to 1.15 per cent of carbon.
No. 5 shall contain 1.15 to 1.25 per cent of carbon.

GROUPING OF TOOLS INTO TEMPER CLASSES.

The grade letter opposite each item specifies the proper choice of grade.

Temper No. 1.

Crowbars	D
Pinchbars	D
Pick Points	D
Wrenches	D
Sledges	C
Hammers	C
Rivet Sets	B

Should not be heated over 1800° Fahr. for forging. Hardens at 1485° Fahr. Temper drawn to suit character of work.

Should be annealed at 1300-1350° Fahr.

Temper No. 2.

Smith Tools	C
Track Tools	C
Boilermakers' Tools	C

Should not be heated over 1800° Fahr. for forging. Hardens at 1480° Fahr. Temper drawn to suit character of work.

Should be annealed at 1300-1350° Fahr.

Temper No. 3.

Cold Chisels	C
Hot Chisels	C
Rock Drills	C
Shear Blades	B
Punching Tools	B

Should not be heated over 1750° Fahr. for forging. Hardens at 1465° Fahr. Temper drawn to suit character of work.

Should be annealed at 1300-1350° Fahr.

Temper No. 4.

Machine Drills	B
Counter Bores	B
Milling Cutters	B
General Machine Shop Tools	B
Carbon Lathe Tools	A
Taps	A
Dies	A
Reamers	A

Should not be heated over 1700° Fahr. for forging. Hardens at 1460° Fahr. Temper drawn to suit character of work.

Should be annealed at 1300-1350° Fahr.

Temper No. 5. Brass Tools ....A Finishing Tools ....A Small Machine Shop Tools..A	Should not be heated over 1700° Fahr. for forging. Hardens at 1455° Fahr. Temper drawn to suit character of work. Should be annealed at 1300-1350° Fahr.

PRESIDENT: The paper is now before you for discussion.

MR. J. M. SAMPSON: I would like to ask Mr. Sullivan what pyrometer he has in use that will vary anywhere from 15° to 35° in a day? If they vary that much and there is that much depending upon 15° or 35° difference in temperature, I do not see the use in trying to take the temperature. With all the pyrometers I have ever used personally, I have never had any such variations. If I found one that varied 15° F. I would not use it.

In using pyrometers it will depend upon what kind of work they are going to be used for. In my work, 15° F. is not going to make a great deal of difference. But even with that, as long as you have to aim at a certain ideal anyhow, it is just as well to approach that ideal as nearly as possible. I want to ask Mr. Sullivan if he really found such great variations.

MR. SULLIVAN: That point is very well taken. I have seen pyrometer measurements vary 35° and even 90°, but the error was not in the pyrometer. Pyrometer readings will vary from one day to another 15°to 20°, unless proper care is exercised. When the temperature is taken from the lead or fire end, something incidental in the mechanism or line, such as a switch or joint, may cause the pyrometer to read off.

MR. SAMPSON: What is the use of checking up your fire end if you are going to have mistakes in the line?

MR. SULLIVAN: The only way to guard against these mistakes is to check them up and correct them in the reading.

MR. SAMPSON: But it is not possible to do it every day.

MR. SULLIVAN: Possibly in your work it is not necessary to do it every day; but there are lines of work where great accuracy is required.

PRESIDENT: Mr. W. A. Emmett, may we hear something from your point of view?

MR. W. A. EMMETT: I do not know that I have anything to say. From the pictures shown, I have seen tools act like that exactly. I believe I have learned something along that line.

MR. W. T. SCHOMBERG: There are a number of members and visitors here this evening who know a great deal about tool steel, the treatment of tool steel, and the use of tool steel, and if some of these would get up and talk I am sure it would be very interesting to the rest of us. Several points were brought out, but for men who have the practical end of the tool dressing and the use of the tools there is scarcely any chance for them to get into the discussion.

The critical point was mentioned, and it was stated that steel, both carbon and high speed, would be practically worthless after it had been heated above the critical point. That is generally understood. But the person who uses the tools, the machinist, also come into play. A good tool can be destroyed by grinding. I think these things should be brought out. I would like to ask Mr. Sullivan whether he recommends grinding a high speed steel tool on a wet stone or a dry stone?

MR. SULLIVAN: In what the gentleman has just said is the spirit of this whole paper. It has not been, and is not my purpose, to make this an academic discussion at all. We want to make this a matter of plain common-sense based upon the facts and to be sure that nothing gets by the man who is doing the work every day. He is the man upon whom the success or failure of the tool depends, in so far as proper forging and treating are concerned. Tools are turned over to men in the plant to use; therefore the combination comes in between the man who dresses the tools and the man who uses them. It is just as necessary for the man who uses the tool to know something of the critical ranges of the steels he is using, and if a tool fails, to have an idea as to why it failed. He should in turn go back to the smith or tool dresser in charge, and say this tool has failed, I believe, for such and such a reason, or, I understand that this results from a certain condition, brought about by treating the steel too hot, or not treating it hot enough, etc., and if it is treated properly it will not act in this manner. In this co-operation much more uniform and satisfactory service will be obtained.

I wish to bring out from the shop point of view, one thing that may seem in this paper a little involved to some.

We know that when steel of known composition is heated to a certain definite temperature, it changes from one mineral condition to another, and if heated to a definite temperature, depending on the nature of the material, we get either the right or wrong condition. This can be made a very intricate technical discussion, but that is not my purpose at all. What I wish to impress upon you now is, that in order to obtain anything like maximum and uniform results in tool service you must observe the care and accuracy necessary in treating tools to develop that condition in the steel that makes maximum and uniform service possible. This can only be accomplished first by having a knowledge of the temperatures at which various carbon contents, as well as high speed or other alloy steels, change over into the proper condition for maximum service, and, second, making sure that you are obtaining that condition as nearly as practicable.

Now as to the grinding of tools. My own experience has been that if you use a little common-sense in grinding you will not heat tools up so that the temper is drawn. In the first place, the head of the grinding room should see that his grinders are properly equipped to grind the tools that must be ground to the best advantage. If they are not, you cannot expect to do good work on them.

Tools are ground not to draw the temper, but to remove some portion that has either been worn out or dulled by service. It is a necessary evil and should be regarded as such.

You heat a carbon tool and quench it in the first place to fix the hardness and then draw it to give it toughness. This leaves a definite mineral combination. If you heat it in grinding to a temperature beyond that to which it was drawn, the mineral condition is changed correspondingly. Therefore, if you grind a reamer of "carbon tool steel" to a blue color, you have destroyed it, because too great an amount of the hardening mineral has been decomposed, and the edge is too soft. We say the temper has been drawn too much. While the same condition exactly does not obtain with high speed steel, yet if you grind a high speed tool hard enough to blue it on the outer edges, while you may not be able to detect it with the naked eye, here is exactly what happens. The expansion and the contraction of a metal as dense as high speed steel, is very slow. The temperature has to be applied carefully, otherwise you will get unequal conditions generally called strains, and the material will either burst or crack. If you suddenly apply an emery wheel to the surface of a hardened high speed steel tool (be it wet or dry), and add a certain amount of pressure, the spot where they contact will heat almost instantly until it is blued. In other words, you have heated that spot until the temperature has been raised to 650 or 700 F. and the heat having localized at that point, the metal has expanded only where that blue color occurs. If observed under a microscope you will find along that blued portion a series of minute cracks, which develop further in service. You cannot detect them with the naked eye, but they are there and if you break the tool through the center of that blued spot, you will find a skin of from .005 to 1/32" deep on the surface, which has pulled away from the body of the steel. The outer edge will be blue and the body of the tool will be its normal color. Therefore, it is a matter of judgment. If you grind tools wet, grind them so that you do not draw the color at all. If you grind them dry, there is no objection to the tool getting hot even to a blue color, but this must result from a general heating of the tool; do not draw the color in spots and do not put in water to cool.

It may be well to add here that the conscientious steel maker is being placed in rather a peculiar position. There are some "salesmen" bold enough to say "you can heat this particular brand of steel without any care. You do not even have to harden it; all you have to do is to work it, and it requires no special attention in grinding." Such remarks are inclined to retard progress and are made either for an object or without any knowledge of the subject. Steels of the same nature have the same characteristics, and require the same attention as regards forging, treating or grinding. If the tool dresser uses sufficient care in forging and definite temperatures in treating, he will turn out high duty and uniform tools, and that is as far as he can go. Grinders properly equipped, used with care and judgment, prolong the life of such tools. Keep your wheels in proper shape prepared to perform their work quickly and economically. Exercise judgment, and that is as far as you can go.

MR. D. J. REDDING: Do I understand you to recommend annealing high speed steel before you harden it? Do you recommend that you must first heat the steel to about 2000° and anneal it, and then heat it over again before you harden it?

MR. SULLIVAN: I made no reference to that. I simply showed a piece of steel in the annealed condition. But that brings up a point I think you are all familiar with. It is a very necessary one to observe. In forging a high speed steel tool you are working that tool at different temperatures, say the heat starting in at the very point; while it may taper off gradually it is really a series of differing temperatures, from the black cold steel out to the point. Therefore, when you forge that steel you are working it at points in that series of different temperatures. After the tool has been forged, say it is a big tool, 3 by 1½″ or 2 by 1¼″, it is a good practice to heat the tool to 1500 to 1600° F. and anneal it so as to take out completely the effect of the forging strains.

A VOICE: I would like to ask if there is any record of hardness made by the sceleriscope from the critical point down say by 50°? What would be the relation of the hardness of 2,000° to that of 2,200°?

MR. SULLIVAN: I do not believe that would be of any particular value. We do not work 50° under the critical point in any case or in any event. Merely as a matter of record it might be interesting to observe the variations in hardness at every 50° increase in temperature. I do not know that it would have any practical value. What we are interested in is obtaining the hardness of the material after it has been treated to the critical point, or proper temperature.

MR. A. STUCKI: Referring especially to carbon steel, the question of obtaining the required hardness is an important one and we can obtain it in two ways. One way is to increase the carbon content and the other is to heat higher and quench more quickly. Both methods have to go hand in hand. If you, for instance, want a steel low in hardness, you use a steel low in carbon, but if you want a real hard material and use steel of a low carbon, you have to quench it so quickly that you get a material more like glass. To avoid such a condition, the carbon content is raised. Carbon, of course, will give us a harder material, but will not destroy the tenacity of the steel as rapidly as excessive tempering. I understood Mr. Sullivan was going to insert a table, showing what percentage of carbon he is using with each degree of hardness, but I would like to hear from him in a general way just what those proportions are.

MR. SULLIVAN: That question covers a lot of ground and is very largely a matter of experience. There is a classification which has been generally adopted and that adoption has been through experience rather than otherwise. Tools of a certain character, like those of the chisel type; of the heavy hammer, sledge or flogging nature, which must combine a great deal of toughness and some hardness, comprise one class. We pass from that condition to cutting tools, that is, counter-borers, reamers, taps, dies, thread cutters, hobs and some forms of blanking dies. You will find all of these tools require about an equal amount of toughness consistent with their form and condition for service. The material being worked, like brass or bronze, often calls for high hardness. Then we have another condition, which is turning very hard material like chilled iron or rolls, that requires extreme hardness. It is largely a matter of experience and it is governed by this fact, the tool must have enough hardness to perform the operation, no matter what it may be, and it must have enough toughness to maintain itself. Whether that combination of hardness and toughness can be obtained with an .85 carbon content or a .95 or 1.10 or 1.50 carbon depends altogether upon the operation.

MR. STUCKI: Ordinarily you use steel from 85 to 120 points in carbon.

MR. SULLIVAN: The general carbon content in commercial tool steels is from 50 to 160. Steel of the latter carbon is used more for chilled iron and roll turning; for milling cutters and tools of keen edge, such as some forms of finishing tools, from 110 to 125.

We have discussed facts that have to do with the treatment of steel, and have applied those facts to the proper care in treating tools. I have been asked many times what has influenced the wonderful progress in this new science called "Heat Treatment," and brought it to its present high state of development. Let us consider for a moment. Within the recollection of all present, dating back say for twenty years, the requirements for steel have been machine tools, locomotive and railroad work, etc. The development along these lines, so far as increased stresses or service was concerned, was taken care of largely by increased dimensions, weight being an important factor in many cases. This was purely a matter of mechanical design, treatment, or increased physical properties in the same sections was not considered.

Then came the automobile with its many parts of limited sections and weight, of many shapes, mostly of irregular dimensions, that must withstand shocks of great frequency,, fatigue, distortion, etc. Numerous and unheard-of conditions had to be met and overcome. It now became a mettalurgical problem and the success of the automobile depended upon the ability of the steel manufacturer to build up the materials and to set forth the manner of treatment for obtaining the necessary physical qualifications for these various parts, as well as means of duplication. In working out these problems the co-operation of designer and manufacturer was imperative.

This marks one of the greatest struggles in the history of steel, in which many new materials have been developed, each to perform some particular function. Our science has been reduced to figures; we measure our temperatures with great accuracy. Rule of thumb has passed and established laws are followed.

Heat treatment in some plants has been carried to a point where is savors of art. This is not the result of mere desire, but of grim necessity. A tool may break or fail and another is made to replace it, but if a crank-shaft, axle, or steering-knuckle fails, it may not only mean the reputation of the car, but loss of life. Therefore, failures must be eliminated. Apparently the failure of a tool is not as serious a matter.

It has been pointed out that there is a definite method by which it is possible to determine the most serviceable condition for a given tool or part, and a means for duplicating that condition.

This is equally true of springs, axles, rails, or boiler-plates, etc. Some might ask why not discuss or apply our present knowledge to a means whereby springs, axles, rails, or boiler-plate failures might be eliminated, for these cause far more concern and are indeed more serious than the failure of ordinary tools.

It is not because we do not appreciate the necessity for so doing, but, unfortunately, we are not in a position to discuss the matter from that angle. The maker of fine steels must maintain a research department, he must keep forging ahead for we are just beginning to see the light.

Many facts are at hand that are of value to railroad men and we are anxious that you take advantage of them. Co-operation is of vital importance. By working together we can do much toward eliminating "failure."

Let us get together on a working basis. Let us make as much use as possible of the information we have.

I have endeavored to set forth certain facts that I feel are needed at this time and I trust they will prove worth while.

MR. D. M. HOWE: Mr. President, before we adjourn I think there is something due the gentleman who prepared the very able paper read before this Club this evening. We have had many papers read before this Club, but none of them more intelligent and instructive than the one just read and discussed by Mr. Sullivan. It has demonstrated to us the closer relation of science to practice. Therefore, I move you that we offer Mr. Sullivan a vote of thanks on behalf of the Club.

The motion was duly seconded and carried.

ON MOTION, Adjourned.

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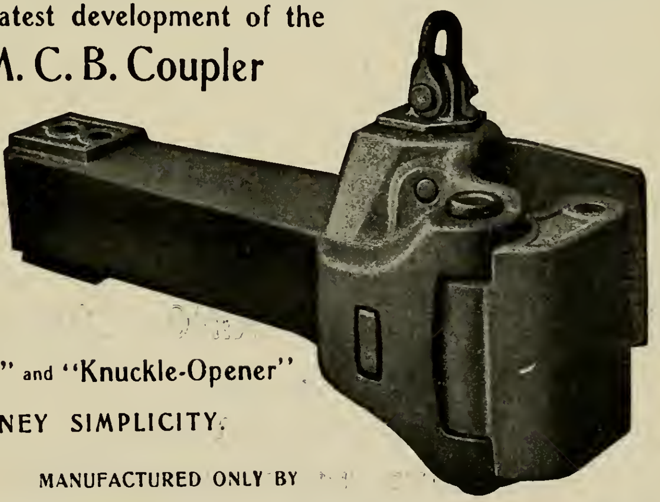

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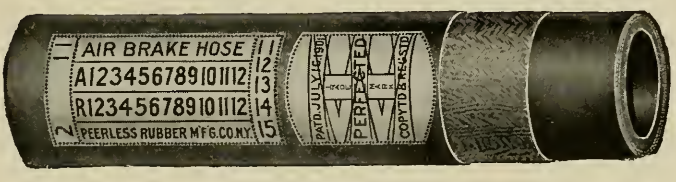

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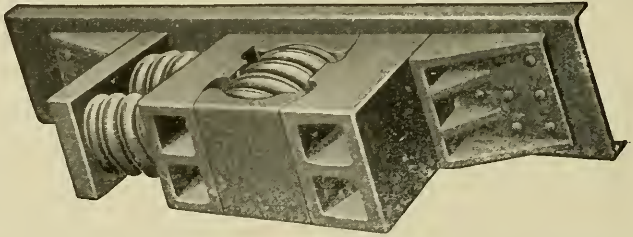

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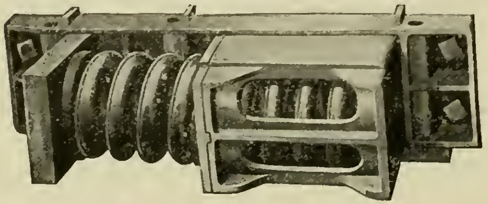

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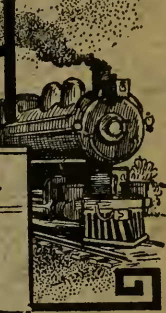

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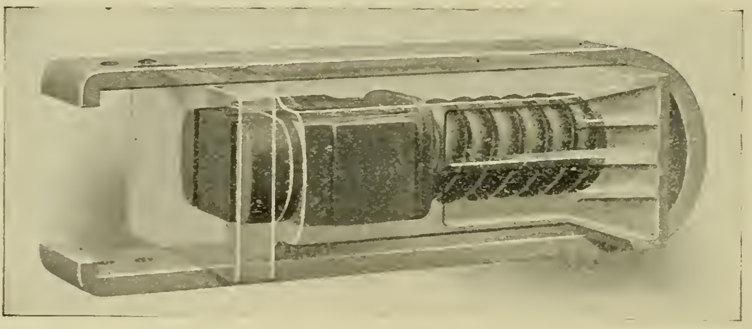

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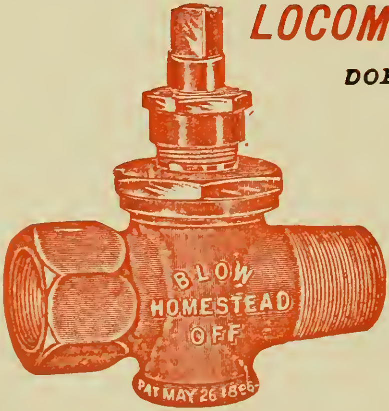

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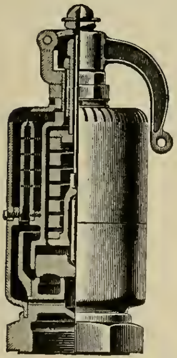

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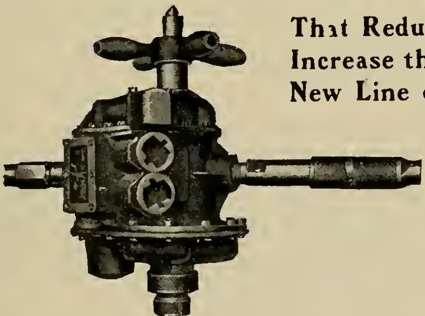

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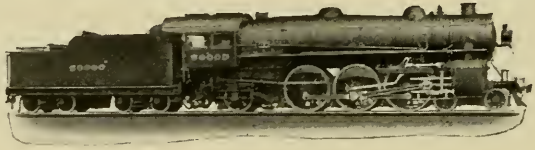

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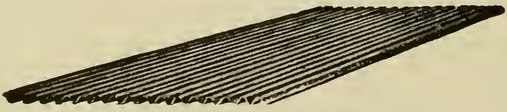

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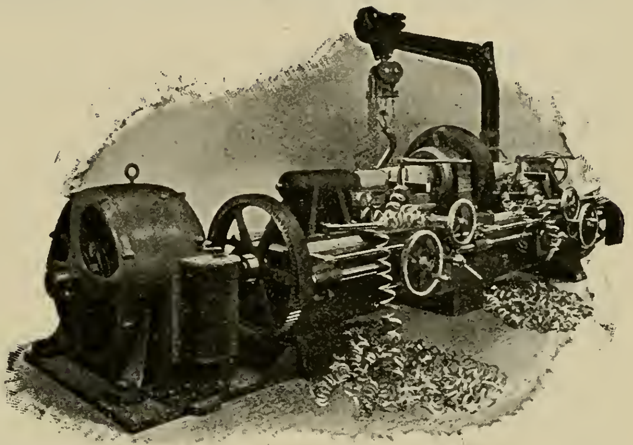

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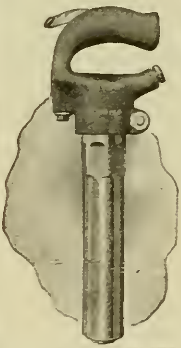

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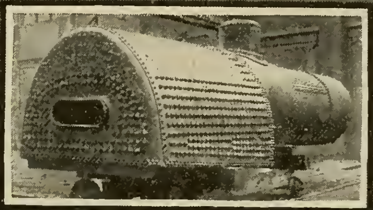

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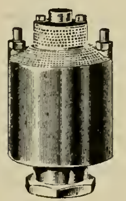

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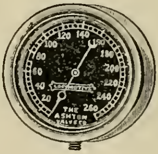

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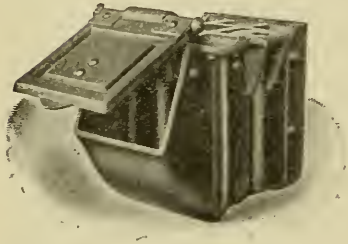

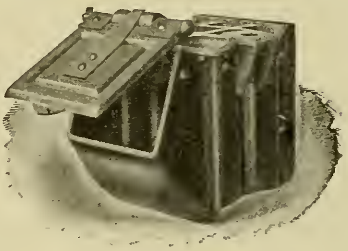

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No. 7.

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McNulty, F. M.
McWilliams, J. B.
Neylon, J. F.
Noble, D. C.
Orbin, Geo. N.
Orner, M. T. S.
Porter, H. V.
Redding, D. J.
Rice, D. S.
Richardson, W. P.
Rivinius, Carl
Robinson, L. O.
Rohn, W. B.
Rupp, R. D.
Sargent, L. L.
Scheck, H. G.
Schiller, John
Schultz, Geo. H.
Shallenberger, C. M.
Sharpley, H. G.
Shumaker, F. S.
Smith, C. E.
Smith, John H.
Spangler, C. P.
Stucki, A.
Suhrie, N.
Trout, W. L.
Voigt, A. J.
Walther, G. C.
Warfield, J. M.
Wescoe, F. B.
White, F. L.
Wyke, J. W.

VISITORS.

Amend, Geo. F.
Anthony, J. T.
Fields, Clarence
Gillette, L. M.
Howe, John
Hug, J.
Kruckerbocker, A. C.
McFail, J. A.

Graham, W. J.
Haugch, R. R.
Neff, John P.
Rohn, Martin B.
Yawman, C. A.

MR. A. G. MITCHELL: In the absence of the President, it falls upon me to preside tonight, and I hope you will assist me in having a very interesting meeting.

As the minutes of the last meeting are in the hands of the printer, we will dispense with the reading of the same.

The Secretary read the following list of applicants for membership:

Shook, H. G., General Yard Master, P. R. R., 164 Forty-fifth Street, Pittsburgh. Recommended by Mr. E. M. Craig.

Wilson, W. W., Jr., Vice-President, Breitwieser & Wilson Co., 445 Oliver Building, Pittsburgh, Pa. Recommended by Mr. A. W. Crouch.

VICE-PRESIDENT: As soon as these applications have been favorably passed upon by the Executive Committee, the gentlemen will become members, without further action.

Next will be reports of committees, and I judge you will all want to know what success we had with the entertainment. I will call upon Mr. Mason to make that report.

MR. S. C. MASON: Our returns are not all in, but we have sufficient before us to assure that the results of the minstrel show will be over $1,000 in the treasury of the Club.

I wish to make public recognition of the work of the different members of the committee, to whose efforts, rather than mine, the success of this is due, viz: Mr. R. H. Blackall, Mr. A. W. Crouch, Mr. C. J. Graham, Mr. F. J. Lanahan, Mr. Norman M. Hench and Mr. E. K. Connelly. They all did splendid work and the success of the show is due to their efforts.

VICE-PRESIDENT: It is very gratifying to hear such a report. Mr. Mason does not include himself in this work, but due credit is owed to him the same as to the others.

MR. A. STUCKI: Mr. President, this is a remarkable report. It is most gratifying to the Club in every way. Such financial returns are no small item; but that is by no means all. It was a noteworthy occasion, and we all enjoyed it. It shows that the Committee worked hard, from the Chairman down to the last minstrel in the row, and I am sure that there was much more work back of it than we can appreciate, especially since the entertainment went off in such a smooth manner. I know that every member of the Club will join me in a hearty vote of thanks to the Committee and to all those who took part in the entertainment or in its preparation. Mr. President, I desire to make such a motion.

The motion was duly seconded and carried by unanimous vote.

ON MOTION the Committee is continued until it makes a final report.

VICE-PRESIDENT: There being no further business to come before the Club, Mr. John P. Neff, Assistant to the President of the American Arch Company, of New York, will read a paper on "The Relation of the Brick Arch to Locomotive Operation."

THE RELATION OF THE BRICK ARCH TO LOCOMOTIVE OPERATION.

BY JOHN P. NEFF.

What does the arch do in a locomotive firebox?

Because of the tremendous activity of combustion on the grate of a modern locomotive an infinitesimal time is available for the combustion of the gases given out by the coal. These gases move with great velocity and the distance through which they must pass while burning is extremely short—shorter than in any other well-known type of steam boiler and yet the activity of combustion is greater than in any other type. These gases must burn before they reach the tubes. The tubes chill the gases and extinguish the flame. Therefore, the gases must burn in the firebox if they burn at all. The fire-brick arch forms a baffle wall in the firebox, compelling the flame to double over it, thus increasing the length of the flame. In doubling over the wall of incandescent fire-brick the gases from the coal are compelled to mix with the air coming through the grate, causing complete combustion of the gases and the air. The arch increases the temperature of the fire. Furthermore, it drives this hotter flame to the back and crown sheets, compelling the flame to impigne against the entire surface of the firebox. This, in brief, is the theory of the arch. It compels every pound of coal to give up more heat.

As the maximum of heat means a maximum of water evaporated, it is the function of the arch to supply a maximum of steam from the coal. With all modern improvements in the locomotive, such as valve gears for improving the distribution of steam, and superheater for improving the condition of operation of the cylinders, large boilers to increase the amount of water evaporated, we still fall back upon the firebox and upon the fire to extort the necessary amount of heat from the coal.

For years arches have contributed to better performance of fireboxes, but it was not until the demand for maximum capacity was felt that the present vital necessity for the arch was finally realized. Because the arch produces more heat from the coal it is an important part of the foundation for the effectiveness of other improvements which have been made in recent years in the locomotive.

With the realization of the possibilities of the arch in this direction came improvements in the arch itself, in the material employed, in the structure and method of support and in the form of the brick which have added to the other good features of the arch, that of convenience in application, low cost of maintenance and facility for inspecting the firebox sheets and conducting necessary repairs. The arch today enables the fireman "to shovel more horse-power through the fire door." Recent improvements in the arch render it possible to secure this advantage and increase the capacity of the fireman, with a minimum of maintenance cost and a maximum of convenience at locomotive terminals.

The brick arch is like the superheater in one respect—the harder you drive your boiler, the more showing it makes. This very fact, in my mind, largely accounts for the revival of the brick arch. When the progress of locomotive design reached that point where clearances and weights became the limiting features; it then became necessary to crowd greater boiler capacity into the limits already reached. To meet the still crying need of greater hauling capacity, boilers had to be forced harder than ever before, and very soon the fireman's capacity became the limiting feature. Still we had with us the need for greater sustained boiler power in order that trains with their increasing tonnage might have their schedules maintained or improved.

Then the question became, "What can be done to get more hauling power for a given amount of coal consumed?"

Valve motion experts have long been working on steam distribution to get the best possible out of the cylinders, but in their work they have had to take the steam just as it came to the chests, and it would appear that they have reached the point where more power can be had only by calling for more steam or for steam of better quality.

The superheater experts have done a great deal by providing the best quality of steam, but back of the steam distribution proposition and back of the superheater work we come to the foundation, the trick of getting heat-units transferred from the coal to the steam with the least possible loss. Anyone riding and observing a modern locomotive being forced to its maximum, must admit that the firebox is the real business end of the power plant.

In order that the superheater may best perform its function it is desirable that the duties of the firebox be so performed that the hottest, cleanest gases are supplied to the flues, so that the proper degree of superheat may be attained with the least possible sacrifice of evaporating surface. That is why you see the superheater people so favorable to the use of brick-arches. The brick arch really performs a double duty in this connection—first, it increases the firebox temperature for any given condition, due to the more nearly perfect combustion brought about by the mixing effect on the gases and air and the lengthening of time for combustion; and, second, the arch, by virtue of its position, forces every part of the firebox heating surface to do its full duty in the matter of evaporation. This is better understood by reference to the series of cuts shown herein.

In Figures 1 and 2 we have endeavored to show what takes place normally in the locomotive firebox under the two conditions with and without the arch. That substantially higher tem-

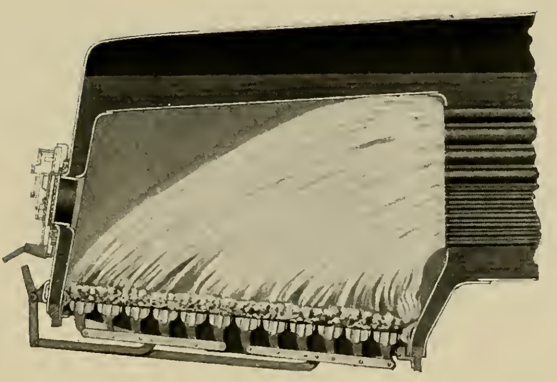


Figure 1.

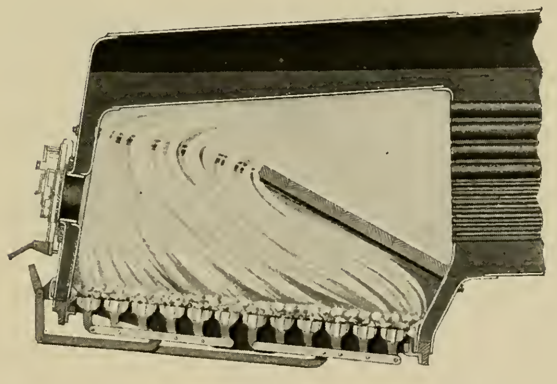


Figure 2.

peratures are produced by the arch is proved by many conclusive tests. The arch must necessarily show a much more even distribution of temperature in the firebox.

A modern hand-fired locomotive working well up to the physical capacity of its fireman, has its fire door open at least 50 per cent of the time. Figures 3 and 4 show the effect of the open door. Without the baffling effect of the arch, sudden and extreme fluctuations of temperature over part of the flue sheet must result. Is it any wonder that locomotives with well designed arches give 30 to 50 per cent less flue trouble than the same engines without arches?

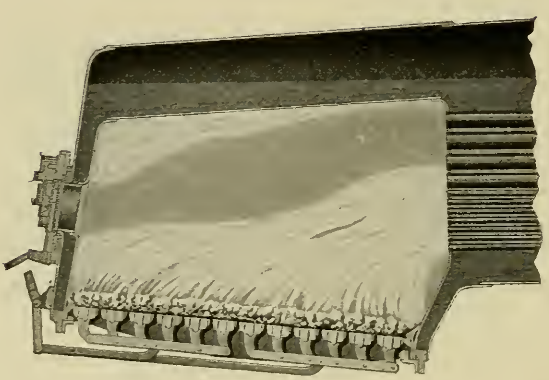


Figure 3.

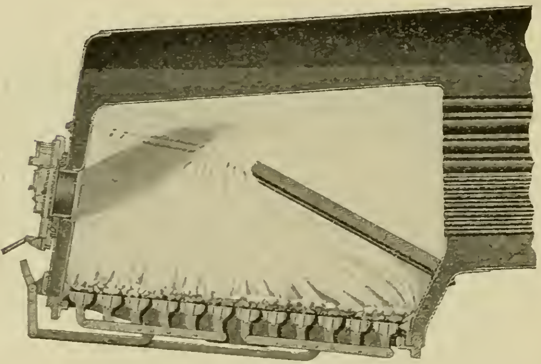


Figure 4.

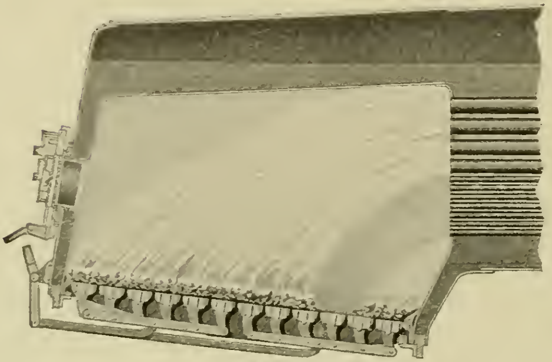


Figure 5.

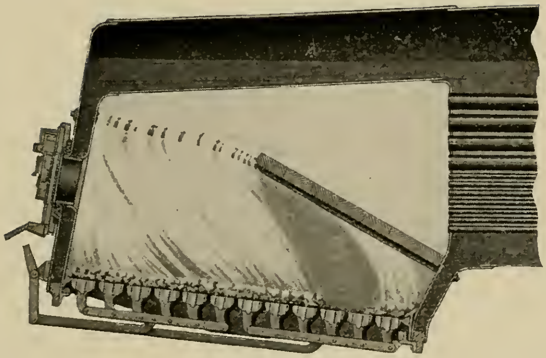


Figure 6.

Figures 5 and 6 show rather an extreme condition, yet this extreme condition occurs with more or less frequency, the frequency being more for a no-arch condition and less for an arch condition, due to the fact that the arch has a tendency, not to reduce the force of the draft as a whole, but to distribute the draft over the entire grate more evenly, thereby reducing the liability of tearing holes in the fire.

The above illustrates how and why the brick arch produces beneficial results. Below we give a few facts that prove our theory to be correct.

A very elaborate report was presented to the Master Boiler Makers' Association at its convention in this city just last week, on the subject of "Advantages and Disadvantages of the Brick Arch and Arch Tubes in Locomotive Fireboxes." This report is quite conclusive in that fifty members contribute conditions and facts as they were found to exist on thirty of the prominent roads in this country using brick arches. A composite of the fifty reports reads as follows:

Average coal saving due to brick arch, other things being equal	11.9%
Average smoke abatement	40 %
Average reduction in frequency of caulking flues	40 %

Attitude of engineers and firemen toward arches—Unanimous in favor.

A large majority of the reports from the various roads shows that the arch is effective in improving steaming qualities and reducing engine failures.

There were many other features reported on by the Boiler Makers, but the above points are the ones that bear directly on our subject which has to do with the locomotive operation.

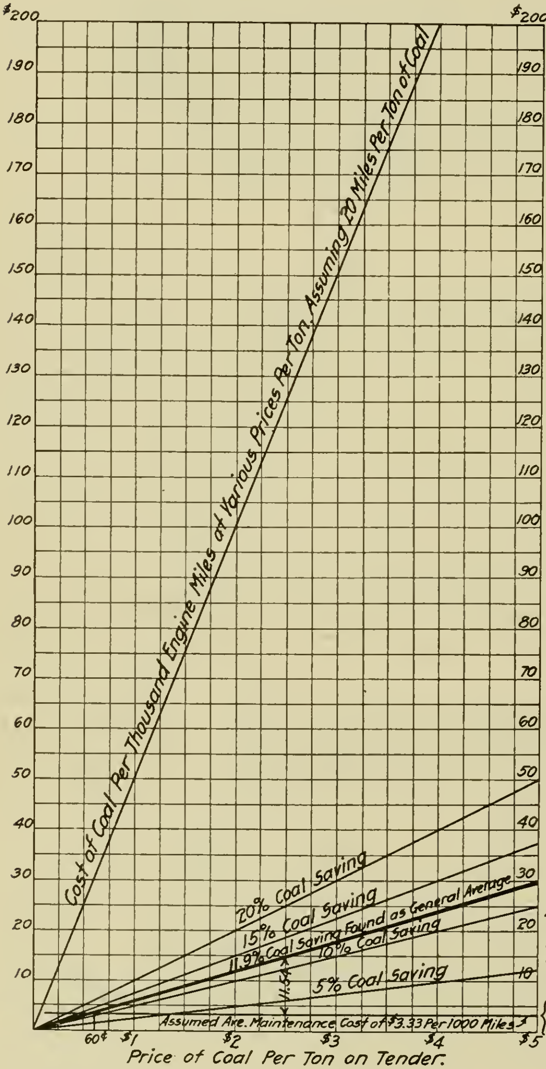


Figure 7.

Explanation of Chart.

This Chart is for the purpose of determining in an easy way the net result to be derived from a subtraction of the total cost of maintenance of arches and arch pipes from the total coal saving figure, all on a basis of dollars per thousand engine miles. In this an average is assumed of 20 mi. per ton of coal, and an average total maintenance cost for arches and arch pipes of $3.33 per thousand engine miles. Note that the base shows the price per ton of coal on the tender, running from 0 up to $5 per ton, each ordinate representing 25¢. Four inclined lines representing 4 different percentages are shown, for 5, 10, 15 and 20% respectively. The 11.9% line is the general average line. Knowing the price of coal on the tender, the net saving can be determined by taking the difference between the maintenance cost line and the 11.9% coal saving line for any given price of coal.

Example-At $2.50 per ton, this difference is 11.54=$11.54 net saving per thousand engine miles.

At a price of 60¢ per ton the two lines cross, meaning that the net becomes -0- at 60¢ per ton.

Maintenance cost per one thousand engine miles for arches and arch pipes

Now, in an endeavor to answer that question as to the financial saving to the railroads by the use of brick arches, simply from the fuel standpoint, I have constructed a chart, the values for which I have taken from the very exhaustive Boiler Makers' report of facts.

By the use of this chart (Figure 7), anyone wishing to know approximately how much brick arches will save for him, can very readily gain a fairly close idea if he knows certain governing conditions.

These governing conditions are:

First—The price of coal per ton on the tender.

Second—The nature of the coal as to per cent of volatile matter, etc.

Third—The degree of severity of the service, or, in other words, the ruling rate of combustion.

Fourth—The design of the firebox and how close such firebox proportions will permit of an approach to the ideal arch design.

The last three items should be considered together in arriving at the percentage value or in choosing the proper per cent line. An extreme combination of conditions would be: (a) A low volatile grade of coal. (b) A low rate of combustion, say 30# per square foot of grate per hour. (c) A shallow firebox with low crown sheet which permits of only a comparatively short arch, say 25% of the grate surface. For such a combination, a low saving per cent line must be chosen, say, not over 5%.

Another extreme combination of conditions would be: (a) Highly volatile coal, say approaching lignits or even semi-lignits. (b) High rate of combustion, say, 130# of coal per square foot of grate per hour, and (c) An ideal firebox design permitting an arch of at least 66% of the grate area, to be employed, with ample firing clearance between the grates and the front end of the arch. This combination would warrant one in choosing a high percentage line; the 20% line would not be far amiss.

If the conditions were such as to represent the general average conditions of bituminous coal engines, the 11.9% line should be chosen, and, for an example, let us see what this 11.9% line will give.

In the first place it shows that with coal at 60c per ton on the tender, there is an even break, that is, the cost of maintaining brick arches just equals the money saving in coal.

Assuming coal at $2.25 on the tender, the net saving is $11.54 per thousand engine miles.

This is on a basis of brick arch maintenance cost being $3.33 per thousand engine miles, as taken from the Boiler Makers' report, and undoubtedly comes close to the average figure the country over. However, a great many roads that have recently taken up the arch, are obtaining a much lower figure for maintenance than that shown. Our work for the past few years has been to develop and improve the brick arch to the end that arches may be so designed and constructed as to give the maximum results in the way of benefits with the minimum of maintenance cost.

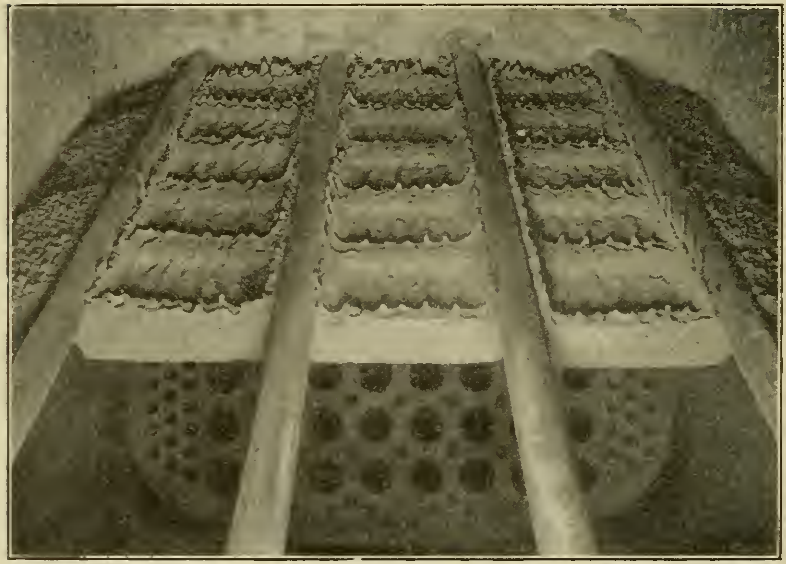


Figure 8.

The photograph shown here as Figure 8 is of the interior of a locomotive firebox showing an arch after two weeks' service. It represents what we consider the best arrangement to date.

The brick units are all of an ideal size for handling; they can be removed and replaced when necessary with a minimum loss. For stay-bolt test only a small percentage of the brick need be disturbed. For flue attention only one-fifth of the arch need come down. In other words, the expense and the inconvenience attendant to the up-keep are by virtue of this design, reduced to a minimum—a practical, inexpensive brick arch for modern conditions of locomotive operation.

VICE-PRESIDENT: Gentlemen, the question is now open for discussion. I will first call on Mr. D. J. Redding.

MR. D. J. REDDING: Mr. President and Gentlemen—We use brick arches in passenger service. We have not gone into the arch question to any extent in freight engines, although we ran some tests last summer with brick arches in freight engines, and I must say that we did not find very much saving in coal. We have that condition of which Mr. Neff speaks, a low volatile coal, which we consider a very good grade, Pittsburgh steam coal. From the standpoint of coal consumption we can not find that there is anything to be gained by running an arch in freight engines.

I believe there is a great deal to be gained in the matter of combustion of smoke, which is a very vital question now in the Pittsburgh district. We are just now applying arches to some switch engines that work in Pittsburgh in a further effort to avoid trouble with the authorities on the smoke question. Some of the railroads in this district have gone so far, I believe, as to burn coke. They could probably keep within the limits of the law with a well-designed arch and burn coal.

Mr. Neff spoke about the discussion at the Master Boilermakers' Convention. I did not hear all the paper, but I understand there was a very complete report made. I was quite surprised at the statements made there by some of the members as to the cost of maintenance, particularly maintenance of arch-tubes. While I was there I heard a Master Boiler Maker say that the average life of tubes on his road was only three weeks and that the tubes would bag down after two or three weeks' service and had to be taken out. We have not had any such experience on our passenger engines as that. I looked up some figures on that today, and going over it just roughly it appeared that the average life of the tubes in our engines was about a year.

That is, we run from three to four tubes to a boiler and each boiler averages only between three and four tubes for a year's service. Possibly we are using an exceptionally good grade of steel tube. That may have something to do with the prolonged life we are getting from them. I think the figures mentionel by the Boiler Makers' Committee are very high. I would say that our cost for brick is less than half of the figures they gave there per 1,000 miles.

I believe that where coal of a high volatile content is burned, such as is used on probably the greater percentage of the railways of the country, there is no question about the great saving that can be made by the use of the brick arch. It is just simply a question of the saving of money in the purchase of coal. From the other standpoint of saving tubes and preventing excessive work in the fire box, there is no question in my mind that the arch has a great deal to do with it there and will save a great deal of money. If we leave an arch out of our passenger engines now, we naturally expect to hear of a tube failure. We have come to consider that we can not get along without the arch in passenger service, particularly with engines that are worked pretty hard. I think from the general standpoint of efficiency and economy, there is no question that a great saving can be effected in the use of an arch, but we do not find very much of a saving in coal in freight service.

VICE-PRESIDENT: Mr. H. H. Maxfield, Master Mechanic, P. R. R.:

MR. H. H. MAXFIELD: We have been using the brick arch in some of our passenger power on the Pittsburgh Division for close on to a year. We have 17 out of 43 of our Pacific type engines fitted with brick arches and we think we are getting pretty good service out of it. I was a little surprised when I looked at a few figures this afternoon, however. They were very much lower than what the Boiler Makers' Association gave, and much lower than I expected.

As to the saving in tubes, the engines that do not have brick arches show about 33% more calking than the engines equipped with brick arches. There is no question as to the value of the brick arch, especially from the theoretical standpoint, and if we can save from 12 to 15% of the cost of the coal, in other words if $1 spent in coal without brick arch can be reduced to 85c in a locomotive equipped with brick arch, it is going to make a very large saving in the total cost of coal, which is in itself one of the principal items in operating expenses.

Of course, the other side of it is the cost of maintenance, and from the figures that I have it looks as if that was not a very serious problem. There is one danger in connection with the use of the brick arch, and that is the possibility of the inspector not giving the tubes proper inspection. It is a pretty difficult thing, without knocking the fire out of the boiler, to make a proper inspection of the tubes, and because of this there is a possibility of failure on the road, whereas, if the actual condition of the tubes had been known a little attention would have prevented such failure.

VICE-PRESIDENT: Mr. D. S. Rice, Boiler Shop Foreman, P. R. R.:

MR. D. S. RICE: I have had some experience for the past year with brick arches, but Mr. Maxfield, our Master Mechanic, has told you about all I could say. We have experienced less trouble with flue leakage and flue work on engines equipped with the arch.

VICE-PRESIDENT: Mr. W. P. Richardson, Mechanical Engineer, P. & L. E. R. R.:

MR. W. P. RICHARDSON: We made some tests with arches under conditions as Mr. Redding has outlined them, and we found that the saving on freight engines was not very great. We ran a series of tests of about thirty trips and the results obtained were so low in efficiency that we decided to re-run the tests until we had satisfied ourselves that the results were correct. We did so and found the efficiency was only a 3% increase over what it was when we had no arches.

VICE-PRESIDENT: Mr. M. A. Malloy, Master Mechanic, P. R. R.:

MR. M. A. MALLOY: I have had no experience with the brick arch recently. But I know that years ago any economy that was shown in coal was offset by maintenance and the length of wait for the engine to cool off. There was a question at that time whether there was much saving. I have had no experience of late years. The arch no doubt has been improved.

VICE-PRESIDENT: Mr. John Howe, Boiler Maker Foreman, B. & O. R. R.:

MR. JOHN HOWE: We use brick arches in both our passenger and freight engines, also our yard engines, and we have been getting good results. We find our flue leakage reduced considerable, and a great saving in fuel with our yard engines that are equipped with arches.

We have been using front end cinders for fuel and we get good results from same. We are not having any trouble with our arch tubes in regards to blistering or leaking. We clean our tubes each time the boiler is washed. The brick arch is a protection to flues and prolongs their life. We have instructions to equip all our locomotives with brick arches. I think the arch is a great benefit to a locomotive.

VICE-PRESIDENT: Mr. W. J. Graham, Boiler Inspector, L. S. & M. S. R. R.:

MR. W. J. GRAHAM: The brick arch is a great benefit to the locomotive boiler. The new design of arch can be applied and maintained at less cost than the older designs of arches. I was present in a road foreman of engine's office when an efficient fireman had been charged with fourteen cases of low steam and he was about to be taken off of his run, that he had earned by good and faithful service. He maintained that he had put forth his best efforts and that he was going to put up a fight for his rights to hold his run in passenger service. He said that he did not think any other person could do more in the way of maintaining the steam pressure in boilers than he had done. He also declared that he would, with the aid of the Firemen's Brotherhood, make an effort to hold his run against the decision of the Road Foreman of Engines, who had decided that this fireman would have to take a freight run. After the fireman had made known his intentions and departed from the office, I called the Road Foreman's attention to the fact that the fireboxes of engines on this railroad were not in the proper condition for obtaining and maintaining the maximum boiler steam pressure. I stated that the boxes lacked the brick arch, which would have made it possible for this fireman to obtain the required steam pressure and avoid failure. The Road Foreman said he had to do something; that he would have to answer the letter from his Master Mechanic, and he thought the best way out of it was to put another fireman in this man's place. Immediately after this episode, the new design of a brick arch for low boilers was applied to all boilers on that railway, and after a demonstration and trial the brick arch enabled the fireman to maintain the required steam pressure in the boiler. The blame previously attached to the firemen is now taken away and they are all good firemen with the aid of the brick arch. The arch tubes used for the support of the arches were in the days past hard to maintain. These tubes now can be cleaned by the use of a turbine cleaner and if properly used at every wash-out, these tubes can be thoroughly cleaned, and the tubes will last in service for a greater period. There is also a filling which forms upon the arches. This filling consists of a honeycomb which forms on the tube beads and upon the button-head stays in the crown sheet and then falls upon the top of the arch, and with the small particles of fuel added make a clog on the top of the arches that must be cleaned off. The cleaning of the top of the arches can be accomplished quickly. I have cleaned the filling found upon the top of the arch in a locomotive boiler within sixteen minutes after the fire had been withdrawn. The center row of bricks which forms the arch can be removed with the aid of a pair of tongs, the arch cleaned off and the bricks replaced. A brick arch used in a locomotive fire box requires a little attention as to cleaning off the filling which forms upon the top of the same. I have heard it said tonight that it takes a long time for an arch to cool off. Brick arches properly cleaned and cared for cool off quickly after fires have been withdrawn. A neglected arch will retain heat for a long time on account of the heat in the filling found upon the top of neglected arches.

In districts where fuel is furnished at a very low cost it is thought it would not pay to apply a brick arch. I would suggest that if a brick arch were used it would be the means of enabling a fireman to maintain the required steam pressures and would save two or three tons of fuel for each hundred miles traveled. The protection the arch affords the tubes is a feature that is worth the expenditure on all locomotive fire boxes.

VICE-PRESIDENT: Mr. H. G. Scheck, Road Foreman of Engines, P. R. R.:

MR. H. G. SCHECK: We are not using any arches in our engines at present, nor have we used any for a number of years. All our engines several years ago were equipped with arches, but I think it was on account of the expense that the company discontinued using them. The watchword of railroads today is "economy." If arches will effect the economy that has been mentioned here this evening, I am safe in saying it will not be long before all the railroad companies will have all their locomotives equipped with arches. But when we have to examine the staybolts once a week, unless there is an improvement in the new arch over what there was a few years ago in the old ones, there will be no saving effected, as the old arch would melt together.

When the gentleman speaks about an engine being brought on the pit, the fire drawn, the arch removed, repairs made and arch replaced, all in sixteen minutes, I want to tell you he is going some. When you knock the fire out of an engine that is not equipped with a brick arch and go in the fire box sixteen minutes after the fire is out, I will assure you that you will be pretty badly scorched.

There is no doubt in my mind that an engine equipped with an arch will save considerable coal and it eliminates a certain percent of smoke, but, as I said a few moments ago, it is the cost. On some roads running their power close, that is, on short layovers where it becomes necessary to make the inspection in a hurry, and you have to wait for the arch to cool, there is going to be more or less delay. The gentleman says the arch costs three dollars and some cents per thousand miles, and on local runs we are getting from four to six thousand miles per month out of an engine, and if you have to put in a new arch every time you examine the flues and stay bolts, it means considerable money, but there is no question that an engine equipped with a brick arch will save coal.

VICE-PRESIDENT: Mr. G. N. Orbin, Engineer, B. & O. R. R.:

MR. G. N. ORBIN: I do not think that I can add much to what has already been said here this evening. The B. & O. R. R. Company had their engines equipped with brick arches about 25 years ago, but as the fire boxes were small at that time the arches had to be removed to clean or caulk the flues. The arches were laid on angle bars that were supported by studs in the side sheets. I think the company discontinued the use of the arch on account of the high cost of maintenance.

I am handling at present one of the B. & O. Class P1A, which is a Pacific type locomotive equipped with an arch, and have also handled the same class of engine without an arch, and would judge that there is a saving of fuel of about from 10 to 15 per cent, after deducting cost of maintenance, and I certainly think the arch is all right.

VICE-PRESIDENT: Mr. L. L. Sargent, Assistant Road Foreman of Engines, P. R. R.:

MR. L. L. SARGENT: While I am favorable to the brick arch, I do not think I can add anything to what has already been said.

I would like to ask a question: How close should the brick arch be to the flue sheet to get the best results?

MR. NEFF: That is a matter that depends a great deal upon conditions. I should say that the ideal way would be to have no space. There are a great many places where you can not run them that way unless you knock the fire at both ends of the road and pay a good deal of attention to keeping the arch cleaned off. Some people would not try to run an arch that way at all, while other people get very good results. As I say, the local conditions govern.

Certain kinds of coal will have a tendency to carry over. If you have coal with a good deal of dust in it, or if you have a coal that will cause a clinker to form on the crown bolt and drop off, you are liable to get into trouble with an arch tight to the front sheet. Another thing, the draft of the engine has a great deal to do with it. If you can so draft the engine that the bottom flues will always be very active, a great deal of the fine particles that go over will go on through. If the lower flues are sluggish the arch is liable to get banked up on top. I think the proper thing to do where clearance is neccessary is to have about a 5″ space. I do not think it should be any more than just enough to prevent accumulation on top. As I said, the ideal way would be not to have any space there. But if there is much filling up, you have got to have about 5″ in order to keep clear. We can not give any hard and fast rule on that. I have heard heated arguments on that very point between different men on the same division.

MR. SARGENT: My experience has been that where there is a space between the arch and the flue sheet the engine steams better and the lower flues do not clog up, but as the distance between the arch and flue sheet is increased you increase the liability of cold air coming in contact with the flue sheet, thus causing leaky flues, and you do not get all the benefit you expect from the use of the arch, and I thought there was a certain space that could be allowed between the flue sheet and arch that would permit the dirt to fall through and still keep the flues protected from cold drafts.

MR. NEFF: You are correct in that. One of the chief benefits from the arch is the protection of the flues. If you run the arch down close to the flue sheet you protect it from the cold draft coming up and causing that uneven distribution of temperature on the flue sheet. But, on the other hand, if the arch fills up badly a bunch of stopped-up flues will start an engine to leaking about as quickly as cold air will.

MR. REDDING: We have found with the coal we are using that we can get very good results by keeping the two center brick down against the flue sheet and the side brick back about 5″. That seems to allow sufficient space for the passage of the cinder.

VICE-PRESIDENT: Mr. W. L. Trout, Engine House Foreman, P. R. R.:

MR. W. L. TROUT: It has been a good many years since I have had any experience with the brick arch, and the experience I had then was not very favorable to it. It was more detrimental than anything else, as the cost of maintenance and time consumed in the engine house getting engines ready for service, when it was necessary to remove the arch, offset any benefits that were derived from it. But I think these latter-day arches are a great improvement over the old style, when they are so arranged that they can be partially removed without causing such great delays.

VICE-PRESIDENT: We would like to hear from Mr. N. Suhrie, Special Engineman, P. R. R.: He did not hear the paper, but I believe he can talk on the subject from experience.

MR. N. SUHRIE: I was unable to arrive in time to hear the paper, but I want to state that I am very much in favor of the brick arch for the reason that in present-day service required from locomotives the exactions are such that anything that will increase the boiler efficiency is a very necessary adjunct, and there can be no question but that the brick arch will increase the locomotive boiler efficiency, and, in addition, will assist very greatly in reducing smoke nuisance at terminals and when on the road. However, this reduction is more marked when on the road, as the arch is not heated to a high temperature when around terminals. Its chief benefit at terminals is that the building-up process of fires is not so necessary, as it breaks the draft when starting trains from terminals. I happen to be following up the trial of "K29" Locomotive No. 3395, at present on the Pennsylvania Railroad, and anybody questioning the efficiency of the brick arch and the Crawford Underfeed Stoker, as a smoke-consuming device, is invited to make a trip with me over the Pittsburgh Division. When we are receiving proper results from the Crawford Underfeed Stoker, and the proper size brick arch is in place, there is absolutely no smoke emitted when this locomotive is doing very hard service.

On the matter of maintenance of brick arch, it goes without saying that the engine terminals are very badly outgrown, and I feel that our shop people have a very just cause for complaint, but this trouble, I sincerely hope, will be overcome so that the brick arch may be maintained in good condition on all modern locomotives, which is the practice abroad, and is very necessary here, as the fuel economy is a vital question as well as the smoke nuisance, and is becoming more so with the acceleration of commercial growth and the necessity for an increase in size and power of locomotives, and for this reason our firemen will be compelled to fire very much longer than formerly, and anything that can be done to lessen their labor and at the same time haul the tonnage, is a factor of the utmost importance.

The application of the brick arch has been productive of very good results at terminals, suburban passenger service and also through-line service, in starting out of the large terminals, which latter service enables us to use low volatile coal, in which case the arch is not so much needed to assist in the combustion of the coal as it is to break the draft and hold the coal in the fire box a sufficient length of time to burn.

VICE-PRESIDENT: Can you tell us what the saving of coal is between Altoona and Pittsburgh with the new engine over the old type?

MR. SUHRIE: I could not say definitely, as we have not yet made any weighed coal tests.

VICE-PRESIDENT: But there is a considerable saving?

MR. SUHRIE: Yes, sir; a very remarkable saving. I am satisfied at least about 40% as against saturated steam locomotives.

VICE-PRESIDENT: Mr. Stucki, have you anything to say on the subject:

MR. A. STUCKI: I am very glad to have had the opportunity to be here tonight. It was just the kind of a paper we wanted, short and right to the point.

I would like to know just what the development in the building of the arch has been, how we started and what we have come to, as several speakers mentioned the original arch not being satisfactory. At the same time I would like to ask Mr. Neff whether any arches have been used by him in connection with air inlet above the fuel bed, because, as he has said, one of the functions of the arch is to make a combustion chamber out of the fire box. Mr. Neff also spoke about getting the whole grate area active so as to supply the air necessary. Both these points have occasionally been accomplished in another way, namely: by supplying air from the top, with excellent results, too.

Another way of measuring the efficiency, and I think a good one, is to go by the amount of water evaporated. Possibly that would give us the most reliable way of getting at the saving of the arch.

MR. NEFF: With regard to the development, the brick arch is pretty old. It is over 50 years old. Brick arches were first used in this country at the time when we went from wood burners to coal burners. The original arch, as I understand it, was built up of 9″ arch brick like the roof of a furnace or an oven. That is where it got its name of an arch. But today there are probably 90% of our so-called arches that are not in the form of an arch at all. They are baffles. But with the original design of arch, where supported with angle irons or lugs on the side sheets, it was necessary to put in a form and build up the arched roof and let it set. That was too expensive in point of time. Then if there was occasion to do any boiler work, such as testing stay-bolts, caulking flues, or rolling flues, the arch had to come down and be renewed. The proper way to do is to use short units on arch tubes, the units spanning from tube to tube, and in that way each longitudinal course is separated from its adjacent course and only a small part of the arch need be disturbed when boiler work is necessary. That has been in development for some time. I think it is brought up now to a state of development where the maintenance cost is quite materially reduced.

Now, as to the point in regard to introducing air, mentioned by Mr. Stucki, in some cases I think it is quite a valuable thing to introduce air, provided you introduce it in the right way and at the right place. The air should be heated. We are doing that now in the Gaines' Combustion Chamber baffle by bringing outside air up through cores in the brick. The brick is, of course, at an almost incandescent temperature and it heats the air somewhat. The air is discharged backward toward the door to meet the gases and engage them before they get into the combustion chamber. That is effective in reducing the smoke and in doing that, of course it improves combustion. I do not know that I could quote any figures. Mr. Anthony may have some figures on that. I think myself there is a great future for it in fire boxes which are designed to take such an arrangement. You should design the firebox with sufficient area inside the mud ring to allow you to take at least 30″ off the front end of the grate and still have grate surface enough to give you good results. I think if you attempt to do that with old engines you may find the grate area so reduced that your rate of combustion would run up, and whenever your rate of combustion runs up materially your efficiency runs down. I think there is a future for the firebox built with that idea in view. I think that is the cheapest kind of combustion chamber to run. I know it is a great saving on flues.

MR. STUCKI: As I then understand it, the arch has not been perfected in efficiency, strictly speaking, but has been very much improved otherwise, so as to reduce maintenance cost.

In regard to the Gaines' firebox, I may say that it cut the fuel down from 152 pounds to 102 pounds per 1,000-ton miles. But I was wondering whether you ever made any experiments with other combustion fireboxes, or whether so far you have only tried the Gaines' firebox.

MR. NEFF: I have done a great deal of work on what is called the Wade-Nicholson hollow arch, set very much like the ordinary arch, but with cored air passages. This shows some economy over an ordinary arch by bringing air in up the inclined arch through thimbles in the water leg and carrying the air back and discharging it at the top end of the arch.

There was a series of tests run on a hollow arch of that kind at St. Petersburg, Russia, some years ago that showed remarkable economy, but we find that a vertical Gaines' wall proposition is a more practical thing to maintain and we believe gives all the benefits that the hollow inclined baffle gives, provided you have your firebox big enough in the first place to allow such an arrangement to be employed without cutting down your grate area.

There is a system of introducing air over a back arch (an arch crowned up over the fire door) which is quite effective in reducing smoke, but whether there is any increase in real efficiency in evaporating water is some question. I think there is a liability of an excess of air at a point where it does not do as much good as if you had the air coming up through a hot baffle wall.

The firing question is a very important one. The fire should be thin enough so that sufficient air can come up through the grates from liberal openings in the ash pan. The Gaines' combustion scheme brings an additional supply of air up in a peculiar way through a hot wall of brick and catches the volatile gases as they turn over the top of the arch, improving the conditions of combustion as well as reducing smoke.

VICE-PRESIDENT: Could Mr. Anthony add anything to the remarks?

MR. J. T. ANTHONY (Assistant to Mr. Neff): I have had about five years' experience with the Gaines' Combustion Chamber and so far as I know it has been very successful in fuel saving, abating smoke and cinder nuisance, and prolonging life of flues.

The first engine equipped with this device was a 21x32-inch Consolidation which originally had a narrow firebox with 34 square feet of grate. This firebox was replaced by a new one 7 feet wide and with 56 square feet of grate, the box being made long enough to provide a 25″ combustion space between the back of the wall and the flue sheet.

On test this engine showed a coal saving of about 40% over sister engines with narrow firebox and Security Arch, and a saving of 15% over 22x30-inch Consolidation with 54 square feet of grate equipped with Security Arch, while the evaporation was increased from 6 to 8½ pounds of water per pound of coal.

The introduction of heated air at the top of the bridge wall seems to practically kill all smoke, while the baffling effect of the wall, taken together with the low draft (effected by increasing the size of the exhaust nozzles on engines equipped with the Gaines' Arch) reduces the cinder loss at stack to a minimum.

Recently on the Central of Georgia Railway they bricked off combustion chambers in some of their wide firebox Consolidations, reducing the grate area from 54 to 36 square feet, and these engines with a small grate and combustion chamber are hauling the same tonnage and burning a little less coal per square foot of grate than the other engines.

The attached cut illustrates the Gaines' Combustion Chamber as applied to a recent lot of Pacific type engines built by Baldwin for the Central of Georgia, and, as shown, consists of a hollow firebrick wall supported on a steel casting, which is secured to mud-ring at each side. Air is taken in at the bottom through the funnels, is heated up as it passes through the incandescent firebrick wall and is discharged through five 2½″ air-ducts back into the firebox, where it meets the gases of combustion as they pass over the wall. The wall is braced in the rear by cast into buck-stays to prevent toppling and the bottom of combustion chamber is made of cast iron plates supported on angle irons and protected with firebrick to prevent burning out. In the bottom of combustion chamber is shown a spark-hopper with an air-tight sliding cover through which all cinder accumulation can be drawn off when necessary. As the gases expand after passing over the wall the velocity is considerably reduced and most of the cinders are deposited at this point, thus preventing any accumulation in the flues.

MR. REDDING: Mr. Anthony's statement gives the keynote of the situation. They were able to increase their evaporation from 6 to 8½ pounds of water to the pound of coal. That means they were burning a very poor quality of coal. That is the reason we do not get similar results, because we can get an evaporation of ten pounds without using an arch. So, as the gentleman stated, with poor fuel you get better results and show a better saving than where you use good coal, though there is some saving still to be effected with good coal. But the fact that they were only getting 6 evaporation shows that they were using a very inferior grade of coal.

MR. ANTHONY: Yes; using a very inferior grade of coal (run of mine with 13% ash and 30% volatile, 13,000 B. T. U. per pound of coal and 55% fixed carbon) on an engine that was a very poor steamer.

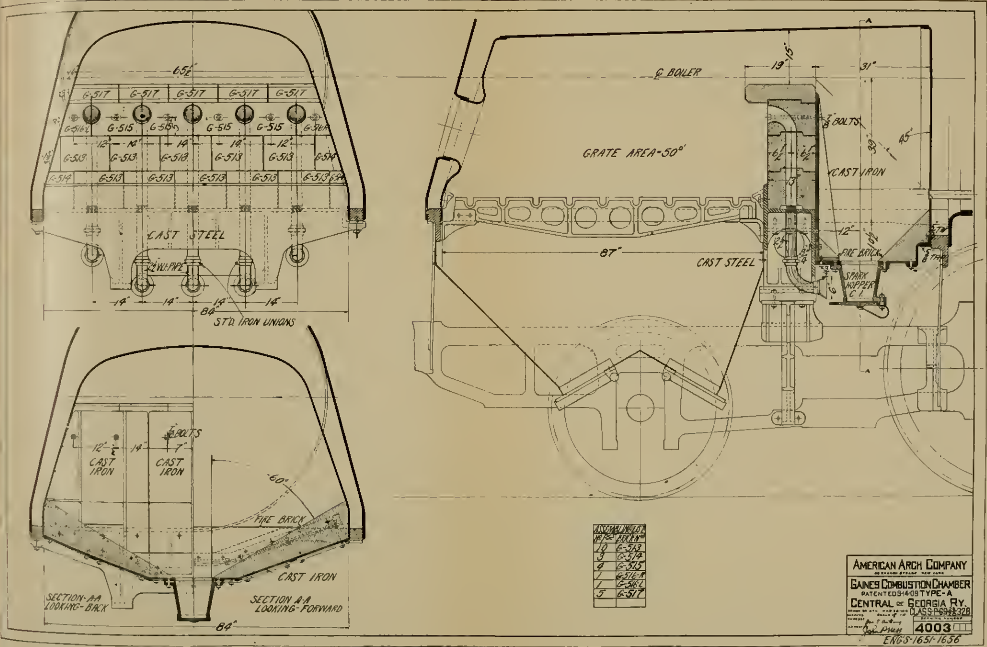
VICE-PRESIDENT: Are there any others sufficiently interested in this subject to speak or ask questions? If so, we will be glad to hear from them.

MR. J. COLE: I would like to ask Mr. Neff if he does not think that in these larger locomotives that are equipped with combustion chambers the lessening of flue troubles is not due to a great extent to the shortening of the flues?

MR. NEFF: If I understand your question correctly the condition is a combustion chamber with short flues.

MR. COLE: Most of the engines that have combustion chambers formed out of the back flue sheet are generally long boiler engines, and in the same size of locomotive without the combustion chamber they would have in the neighborhood of 21 or 22′ flues. When you make a combustion chamber out of the back flue sheet that shortens up the flue to between 18′ and 19′. And a shorter flue, with the experience I have had I have found we have less flue trouble.

MR. NEFF: You are entirely right about that. A combustion chamber engine is a good deal lighter on flue trouble than a long flue engine with ordinary back flue sheet. But the figures



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given on reduction of flue troubles are comparative figures on similar engines with long flues and the ordinary flue sheets. I do not think you can make as much showing from an arch in a combustion chamber engine in the matter of reduction of flue troubles as you can in the more common type of locomotive boiler.

VICE-PRESIDENT: Has any on else anything to suggest? If not, would you like to add anything more to what you have said, Mr. Neff?

MR. NEFF: There are a few points I would like to speak on. I was much interested in what Mr. Redding and Mr. Richardson said in regard to freight engines that did not make a good showing. I am not familiar with the conditions under which those engines operate or what kind of coal you use, but I am somewhat familiar with the design of the firebox. Those are ten-wheel and consolidated engines?

MR. REDDING: Yes.

MR. NEFF: The wide firebox ten-wheel engines and a great many wide-box consolidated engines have not an ideal firebox to run an arch in. You are quite limited as to the firing clearance on account of the shallowness of the throat. As I said in my paper, the design of the firebox had a great deal to do with that. Take the Mikado type engine, the Pacific type, the Prairie type, or the Atlantic type, where there is ample room for a deep firebox, and you can get a distance from the grate surface to the arch at the flue sheet of 18 to 20″. With a good many of the wide box ten-wheel and Consolidated engines you find that space limited down to the neighborhood of 12 to 15″, and it does not take a very heavy fire to be built up to the arch, and when that condition occurs the live grate area becomes reduced. That means an increase in the rate of combustion over the remainder of the grate area, and any increase in the rate of combustion runs down the efficiency of your grate. So possibly that might account for the comparatively poor showing in some classes of engines. I think, in the Mikado type of engine or any other type of freight engine where you have a good depth of throat you will find practically the same economy that you will from the passenger engine with the same kind of box. The economy depends largely on the rate of combustion. Where combustion is slow, that is 30 to 40 lbs.

of coal per square foot of grate per hour, there is not the chance for the showing that you have where the rate is high.

Another point; in regard to the cost of maintenance where Mr. Redding says it is much less than what the Boiler Markers show. You must remember that the Boiler Makers' report was from thirty some railroads, on some of which the conditions are different from what they are with Mr. Redding and Mr. Maxfield. A good many reported on old-style conditions, where it means knocking the arch out. That expression of "knocking out the arch" is dying out, however. That system is not used on such roads as Mr. Redding's and Mr. Maxfield's. It is possible for them to be economical in the use of brick. Where they used to knock out a whole arch, costing four or five dollars, they now remove only a section and lose only a few pieces costing probably a dollar.

The Boiler Makers' report shows every item of expense that can be attributed to the use of an arch. The cost of the brick iself will probably be less than half of the item shown as total maintenance cost in the Boiler Makers' report.

In the matter of waiting for engines to cool down, Mr. Graham put that in a pretty good way. I do not think it is necessary for an engine to cool down. I have removed without breakage every brick out of a firebox in less than an hour's time after the enging came off the pit. That is not very long to wait. You usually have an hour of dead time on the engine. Some places they may not. But you will have that time at least once a week or at every washout period when work can be done, such as blowing out flues and testing stay bolts. The period for washout, staybolt test and flue cleaning should be arranged coincident, then there will be no delay attributable to the arch.

I was interested in Mr. Howe's remarks about burning front-end cinders. There is a great reduction in cinder throwing due to the use of an arch. I think it is safe to say that there is 50% less cinders thrown when a good liberal arch is used that when no arch is used. Cinder nuisance is almost as objectionable as smoke nuisance.

Mr. Graham also spoke about arch tube cleaning. That is a very important thing. Mr. Redding mentioned about a man at the Boiler Makers' convention speaking of getting three weeks' life out of an arch tube. I am familiar with that particular case. It is an extreme condition. There is something the matter. I do not know just what it is, but a good arch tube kept free from scale, should last a year. The Boiler Makers' report showed an average life the country over of 14 months, and some of them reported a great deal longer life than 14 months. So much depends on the care of the tubes and keeping them clean, after having the right material in the tubes in the first place. The best tubing should be used, regardless of price. The setting of the tube is an important thing. The tube should project through the sheets liberally, ⅜ or ½″ and then rolled and belled out. Some bead them over. If they project ⅜ or ½″ and are liberally belled there is no danger of them pulling out. I do not believe I have ever heard of an arch tube disaster in the last three years. I believe it is because of the education along the line of setting arch tubes.

VICE-PRESIDENT: Is there anything further to be added?

MR. STUCKI: It has been shown that the results with improved firebox conditions, even with the flues shortened two or three feet, are far superior to those obtained in ordinary fireboxes and full-length flues. Hence it is plain that the conditions in the latter case will stand improvement, and a good deal at that.

MR. REDDING: I would like to ask one more question. Mr. Neff has had a great deal of experience in equipping locomotives with arches and working out different designs of front ends to make boilers steam more freely. I would like to find out whether he has been able to develop a front end in combination with a brick arch which practically burns up all the cinders? I would like to know whether he finds in going over the country that there is much improvement made along that line or whether it is possible to so arrange the front end or brick so as to practically eliminate the cinder trouble.

MR. NEFF: We have not made any particular study of the front end in connection with the arch. The front end should be so adjusted as to allow an even distribution of the pull on the gases through all the flues. However you accomplish it, that is the end in view. Different roads have different ways of doing it.

I have no information to give along the line of any special development.

MR. REDDING: I do not want to leave the impression that we do not favor the arch or that we do not thoroughly approve of it, though we do not find very much saving of coal in freight engines. We would not give it up on passenger engines, and we may go to it in freight engines yet.

I feel that this has been a very profitable evening for me and I think for the other members, and I wish to offer a motion that we extend to Mr. Neff a vote of thanks for his very able paper and discussion.

The motion was duly seconded and carried by unanimous vote.

VICE-PRESIDENT: As this is the last meeting of the Club before the summer vacation, I wish to urge upon you that when the fourth Friday of September comes, every member of the Club who can possibly attend will be here. Luncheon will be served in the usual place after the close of this meeting.

If there is nothing further a motion to adjourn will be in order.

ON MOTION, Adjourned at 9:50 P. M.

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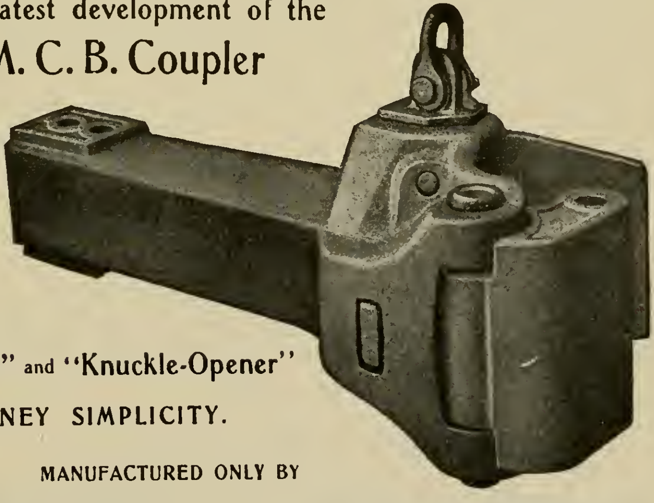

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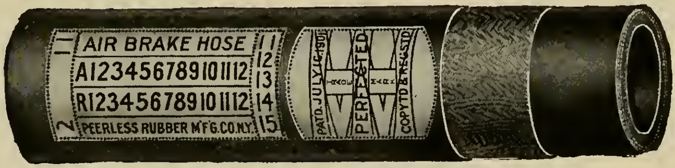

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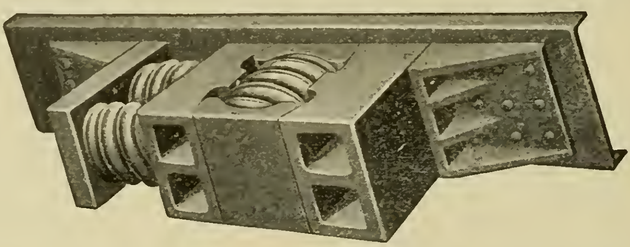

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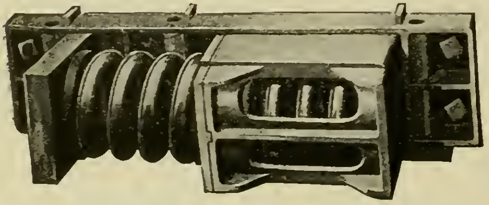

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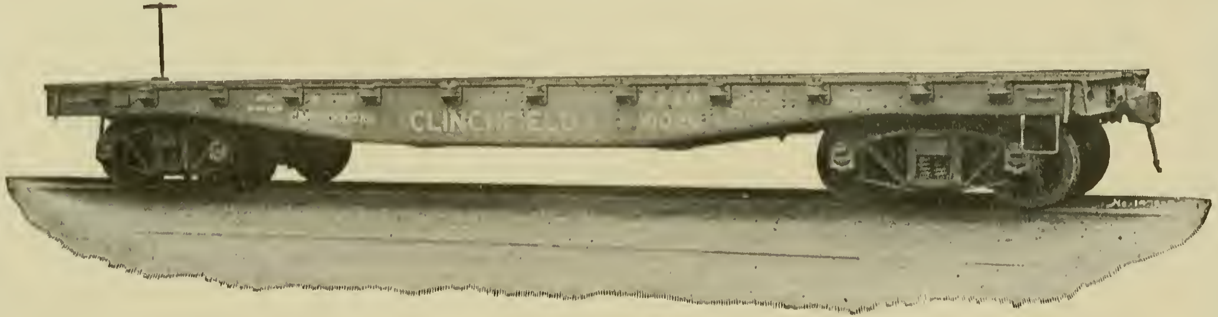

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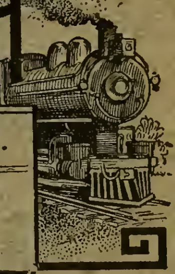

Vol. XI. SEPTEMBER 27, 1912 No. 8.

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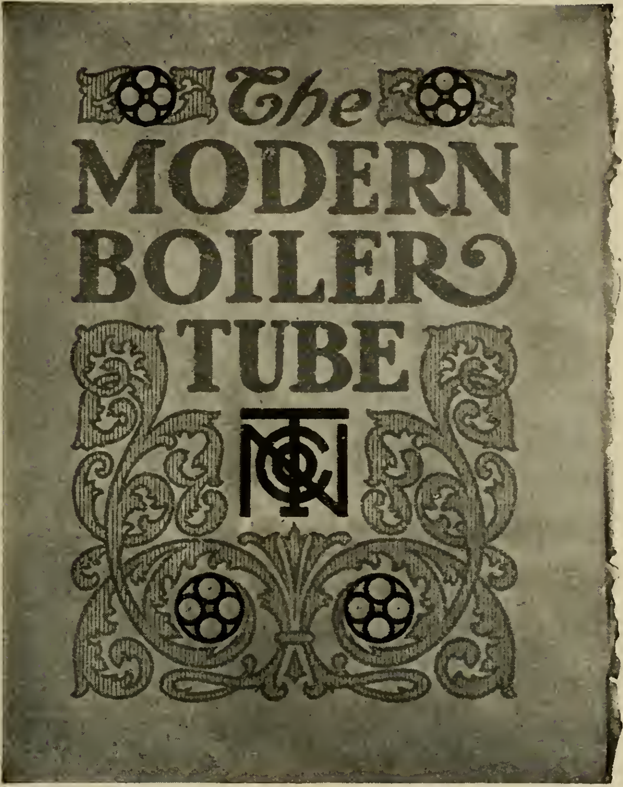

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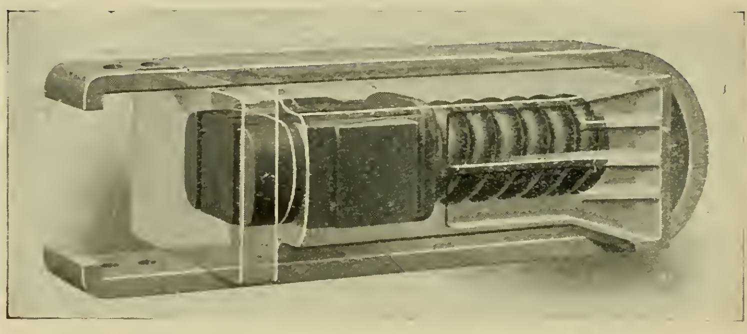

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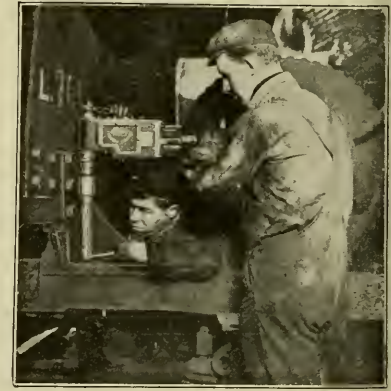

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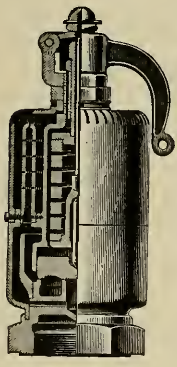

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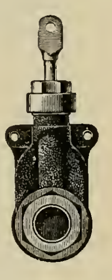

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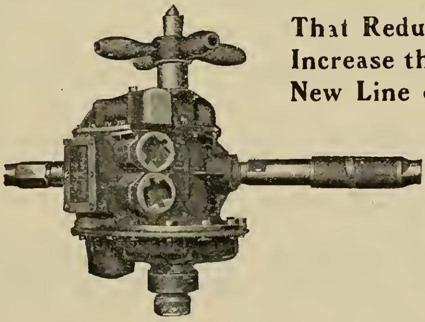

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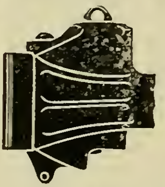

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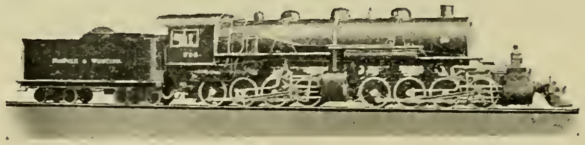

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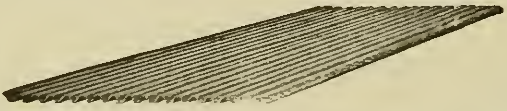

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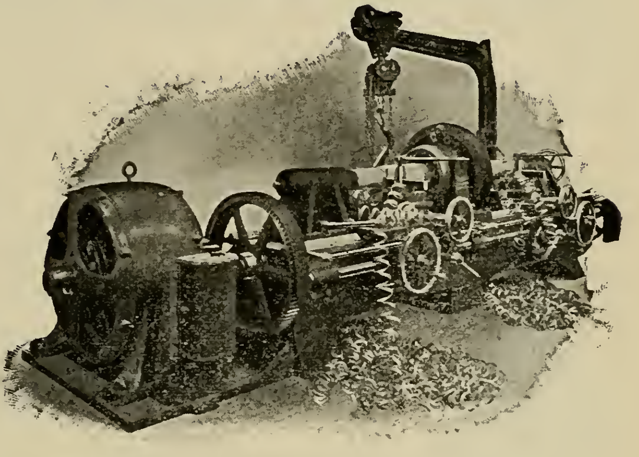

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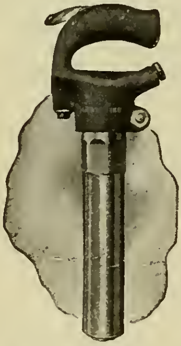

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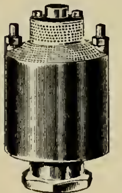

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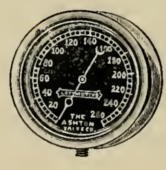

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VOL. XI. No. 8. **Pittsburgh, Pa., September 27, 1912.** $1.00 Per Year 20c Per Copy

Published monthly, except June, July and August, by the Railway Club of Pittsburgh, J. B. Anderson, Secretary, General Offices Penna. R. R., Pittsburgh, Pa.

Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING, SEPTEMBER 27th, 1912.

The regular monthly meeting was called to order at the Monongahela House, Pittsburgh, Pa., at 8 o'clock P. M., with President F. R. McFeatters in the chair.

The following gentlemen registered:

MEMBERS.

Adams, Lewis
Albree, C. B.
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Brownscomb, G. J.
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Cole, Jewett
Collins, C. R.
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Coulter, A. F.
Courtney, D. C.
Cunningham, R. I.
Daily, Irwin P.
Davis, I. J.
Detwiler, U. G.
Drayer, U. S.
Dress, Geo. M.
Dudley, S. W.
Eissler, R. F.
Fitzgerald, D. W.
Frazier, E. L.
George, M. E.
Gies, G. E.
Gilg, Henry F.
Gowdy, H. K.
Graham, W. C.
Grimshaw, F. G.
Guy, W. A.
Hammond, H. S.
Hardman, H. J.
Harner, A. J.
Harriman, H. A.
Haynes, J. E.
Higgins, H. L.
Holt, T. W.
Howe, D. M.
Howe, H.
Huchel, John
Hurley, Theodore
Johnson, W. A.
Jordon, J E.
Kelly, H. B.
Kinch, L. E.
Kleinhans, H.
Knight, E. A.
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Lanning, C. S.
Lanning, J. Frank
Lindstrom, Chas. A.
Lobez, P. L.
Lockwood, B. D.
Lowe, Wilfrid D.
Low, J. R.
Lynn, Samuel
Maxfield, H. H.
Millar, C. W.
Mitchell, A. G.
Murphy, M. J.
McDonough, P. J.
McFeatters, F. R.
McIlvaine, C. L.
McNulty, F. M.
Neff, J. P.
Newman, L. L.
Orner, Milton T. S.
Parke, F. H.
Pearson, A.
Porter, H. V.
Proven, John
Raser, Geo. B.
Redding, D. J.
Rhodes, P. S.
Richardson, C. A.
Richardson, E. F.

Rohn, W. B.
Rumsey, T. O.
Ryan, W. F.
Schneider, G. C.
Sharpley, H. G.
Shook, A. A.
Shook, S. D.
Shumaker, F. S.
Stark, F. H.
Stewart, Wm.
Stucki, A.
Smith, G. H.
Smith, M. A.
Smith, Russell
Taylor, H. G.
Thurlby, A. R.
Toomey, J. J.
Travis, J. H.
Tucker, J. L.
Walters, W. A.
Walther, G. C.
Wescoe. F. B.
White, F. L.
Williams, C. P.
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Wilson, R. S.
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The minutes of the last meeting having been published and sent to the members, the reading of the same was dispensed with.

The Secretary read the following list of applicants for membership:

Boyer, J. B., Loading Expert, The Penna. Steel Co., Steelton, Pa. Recommended by R. H. Mackenzie.

Cotton, A. C., Electrician, Penna. R. R., Union Station, Pittsburgh, Pa. Recommended by H. H. Maxfield.

Farrington, J. C., Foreman, Machine Shop, Pressed Steel Car Co., No. 5 East Orchard Ave., Bellevue, Pa. Recommended by H. Howe.

Finch, H. C., General Manager, Genesee & Wyoming R. R., Retsof, N. Y. Recommended by A. W. Crouch.

Grimshaw, F. G., Assistant Engineer Motive Power, Penna. R. R., Union Station, Pittsburgh, Pa. Recommended by H. H. Maxfield.

Harrison, F. J., Supt. Motive Power, B. R. & P. R. R., DuBois, Pa. Recommended by A. W. Crouch.

Herman, W. J., Traffic Manager, Pgh. Wholesale Lumber Dealers' Association, 541 Wood St., Pittsburgh, Pa. Recommended by R. H. Mackenzie.

Kendrick, J. P., Master Mechanic, B. R. & P. R. R., Punxsutawney, Pa. Recommended by A. W. Crouch.

McCleary, G. T., Clerk, Penna. R. R., Union Station, Pittsburgh, Pa. Recommended by R. H. Mackenzie.

McIlvaine, C. L., Assistant Engineer Motive Power, Penna. R. R., Altoona, Pa. Recommended by H. H. Maxfield.

Neff, John P., Assistant to President, American Arch Co., 30 Church St., New York, N. Y. Recommended by J. B. Anderson.

Newman, L. L., Supervisor Electric Car Lighting, Penna. R. R., Union Station, Pittsburgh, Pa. Recommended by J. B. Anderson.

Rock, W. B., Clerk, Penna. R. R., Box 17, Derry, Pa. Recommended by H. M. Miller.

Weir, Robert M., Superintendent of Yards, Allegheny Steel Co., Brackenridge, Pa. Recommended by R. H. Mackenzie.

PRESIDENT: As soon as these applications have been favorably acted upon by the Executive Committee the gentlemen will become members of the Club.

The Secretary announced the death of H. W. Rinehart, Motive Power Inspector, Pennsylvania R. R.

PRESIDENT: An appropriate minute will be made of the death of Mr. Rinehart.

PRESIDENT: As this is the time when a committee must be appointed to make nominations of officers for the Club for the ensuing year, I will appoint as that Commitee Messrs. D. M. Howe, A. F. Coulter and George E. Gies, and I will ask the Committee to make a report at a later period in this meeting.

There being no further business, I take pleasure in introducing to you Mr. L. J. Hibbard, General Manager of the L. J. Hibbard Co., of New York, who will present the paper of the evening on the subject of "Electric Welding."

ELECTRIC WELDING.

BY MR. L. J. HIBBARD, GEN'L MANAGER L. J. HIBBARD CO.,
NEW YORK, N. Y.

The subject of electric welding is very broad and is today represented in practically every field of engineering. Electric welding is divided into two distinct methods, namely, the resistance method and the arc method. The first is sub-divided into butt welding and spot welding and outside of welding rails in street railway service, is little used in the field of railroad engineering.

The second or arc welding method is self-explanatory and is also sub-divided into two distinct methods, one being the carbon electrode and the other the metal electrode.

The art of welding with the carbon electrode has been employed about 32 years, Bernados being given credit for first employing it on the softer metals. Since that time, like all other operations, it has undergone change after change, until at the present time, instead of requiring a large ampereage, it is accomplished from machines of as low as 300 amperes. This method is employed principally upon heavy work, such as iron and steel castings, locomotive frames, driver wheel spokes, drawhead castings, etc. The carbon electrode method requires usually over twice the current employed by the metal electrode. The potential at the work is as a rule between 50 and 60 volts, while the current runs from 300 to 500 amperes. The method consists of bringing the carbon in contact with the object being repaired and an arc drawn; this arc raises the object metal to a state of fusion while at the same time a metal rod or bar placed in the arc by the operator is also brought to a state of fusion and both are fused together into a homogenous structure. Very often punchings, filings, and small pieces of metal are placed around the cavity to be filled and are gradually fused or run in by a circular motion of the electrode. The carbon method has often been questioned on account of the welded section becoming hard and difficult to machine; but this is due to faulty operation and not to the method itself. There are a great many iron and steel foundry companies today using this method and afterward machining all their castings. The trouble experienced lies in the formation of iron oxide or slag, but the operator can distinguish the color from that of the metal itself and by a circular motion of the arc the oxide or slag is brushed away from the cavity. A small gutter is usually cut from the cavity through which the oxide or slag is continually drained as it forms.

Another great use to which the carbon arc is being employed is the cutting out of sections of fire box sheets when found necessary to build in a patch. This is a quick operation, and while the cut is not as fine as that obtained by the gas methods, it serves the purpose and at the same time bevels the section to which the patch must afterward be welded. The carbon method is valuable in shops, particularly on heavy work.

A short time ago a steel car was held out on account of a broken draft gear steel casting. A wire to the foundry found that a shipment of this casting could not be made under two weeks. The casting was removed and welded and the car returned to service within sixteen hours. This is only one instance of hundreds where time and money are saved.

The metal electrode process employs a lower voltage than the carbon electrode. The potential difference at the work varies from 25 to 40 volts according to the nature of the work. It is particularly essential that the voltage be kept constant, because fluctuation disturbs the arc and is apt to make the weld imperfect. The operator in a short time, with a little practice, becomes skilled enough to determine the current necessary upon merely the inspection of the work. In the process of operation the electrode is brought in contact with the work and quickly drawn back, forming an arc which immediately brings the work to a state of fusion and the electrode itself begins to discharge minute molten increments of repairing metal. The operator continues the process through this arc formation until the electrode has been wholly used up, after which another is inserted in the holder and the work continued.

The principal work to which the metal electrode process is employed is the welding of fire box cracks and open seams; also tubes are welded in place, as well as the repairing of broken bridges in the flue sheet. Perhaps the most striking advantage of this process over all other welding methods is the ease with which cracks and corroded seams in the crown sheet can be welded. An operator can stand directly underneath the arcing electrode and never find it necessary to step aside on account of the detaching increments failing to become firmly welded to the work. The work is always Vd out, either by a pneumatic tool or any other successful cutting device, and the process of filling in is started at the bottom of the V.

The best operating electrode is found to be 3/16″ in diameter and the current varies from 140 to 150 amperes according to the nature of the weld. This is quickly determined by the operator when he is cutting into the metal to prepare for welding. All the work accomplished by the carbon electrode method is also accomplished by the metal electrode, and in addition to this, all classes of boiler sheet and tube work. Another great advantage of the metal electrode method is the concentration and holding of the heat within a small area. The work beyond a few inches of the weld is quite cool after the weld has been accomplished and there is no tendency of cooling strains forming to crystalize or rupture the metal. It will be easily seen that this method has a decided advantage over the gas methods on account of the localization of the heat, because one of the greatest faults of the gas methods is the severe contractions of large areas after the welds have been made. Patches 10 feet long 13″ wide have been welded in fire boxes and no signs of distortion are indicated.

WELDING MACHINES.

There are several types of machines, each type having certain advantages—machines operating the metal electrode alone, and others operating solely the carbon electrode, while a third machine combines the two features and operates both electrodes. Railroads using different types claim that the principle is practically the same in all classes with the metal electrode, although the carbon electrode, if properly operated, is found to work faster on heavy work. The carbon is often used in cutting out cracks for preparing work for the metal electrode. This is particularly true in the welding of locomotive frames and fire box sheets. The *multiple unit* machine type of construction is similar to other metal electrode machines, with the exception that several men can operate from the same machine, the number of men operating from one machine being regulated by the capacity the machine is wound for. The work accomplished by the arc method of welding, particularly that of the metal electrode, is so extensive and covers such a broad field that the possibilities of its application are unlimited. It has been expressed by many using the arc method of electric welding that in their opinion it is but a matter of a short time when this method will supercede all other systems.

REFERRING TO LANTERN SLIDES AND CUTS.

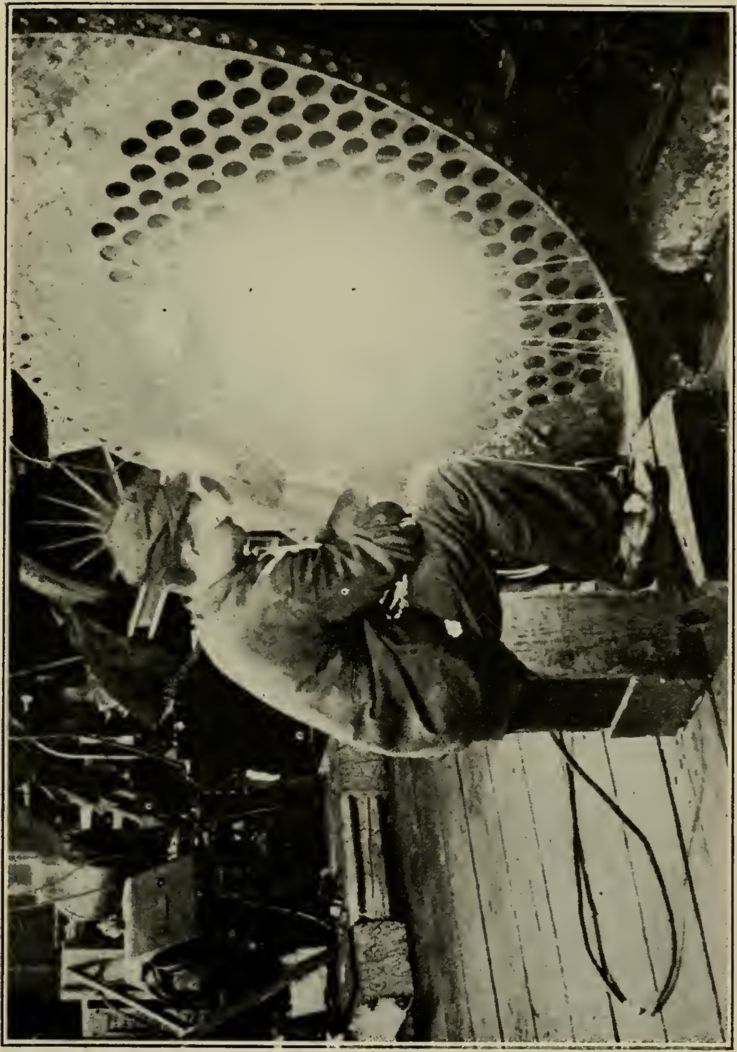

Figure 1.

Figure 1 shows an operator working with the metal electrode upon a flue sheet which has several broken bridges.

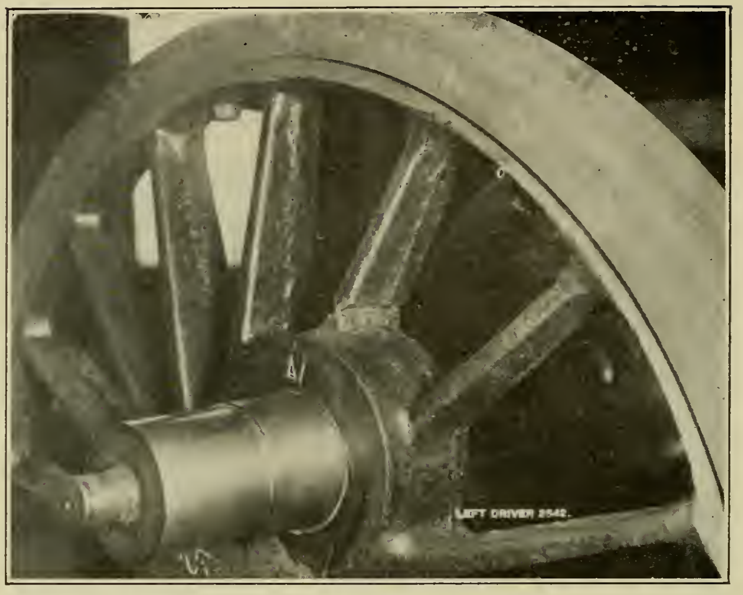

Figure 2.

Figure 2 shows a driver wheel spoke V'd out ready to be welded.

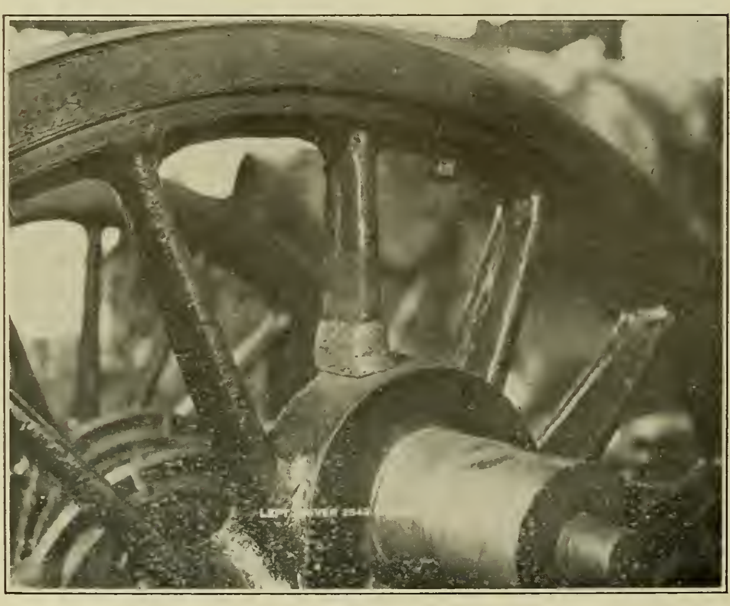

Figure 3.

Figure 3 shows the spoke welded by the metal electrode method.

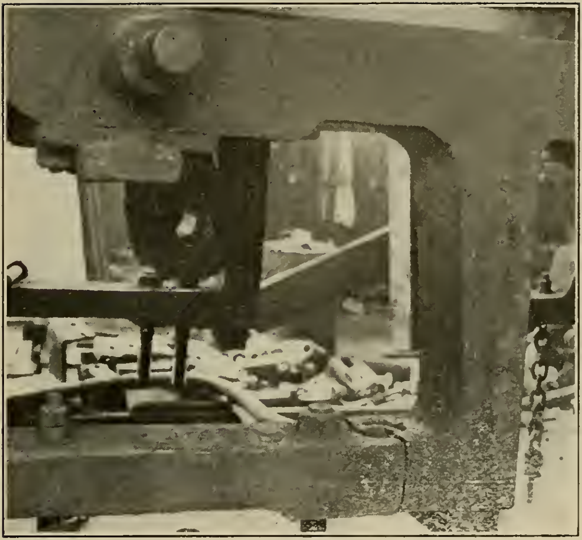

Figure 4.

Figure 4 shows a cracked frame.

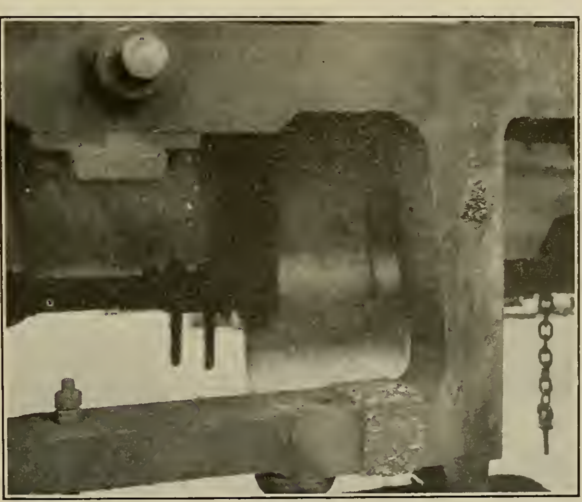

Figure 5.

Figure 5 shows the frame welded by the carbon electrode method, although the same work is accomplished by the metal electrode, but a little longer time is necessary.

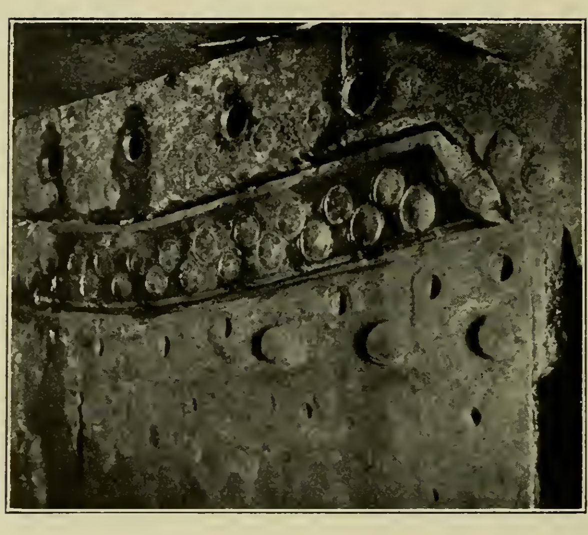

Figure 6.

Figure 6 shows a patch that has been cut out and the new one riveted in place, ready for welding with the metal electrode. The patch was 5 ft. long by 10″ wide, and was located in the flue sheet between the mud ring and the grate water bars.

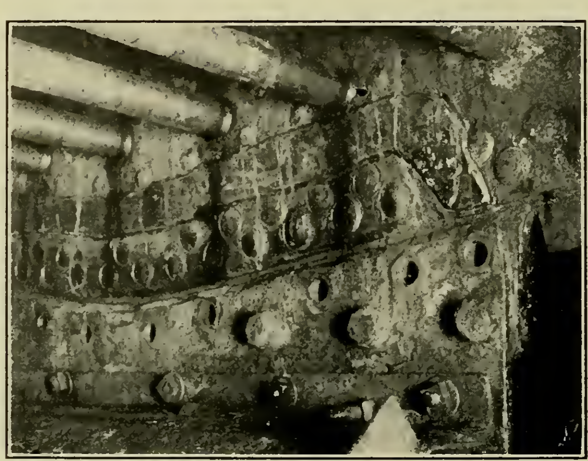

Figure 7.

Figure 7 shows the weld finished.

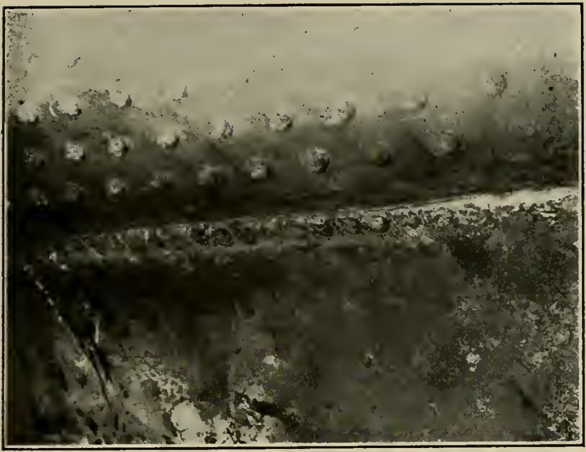

Figure 8.

Figure 8 shows a portion of a badly corroded seam.

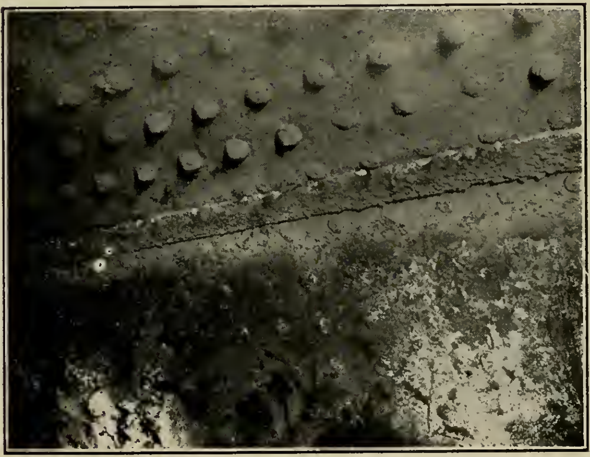

Figure 9.

Figure 9 shows the seam welded.

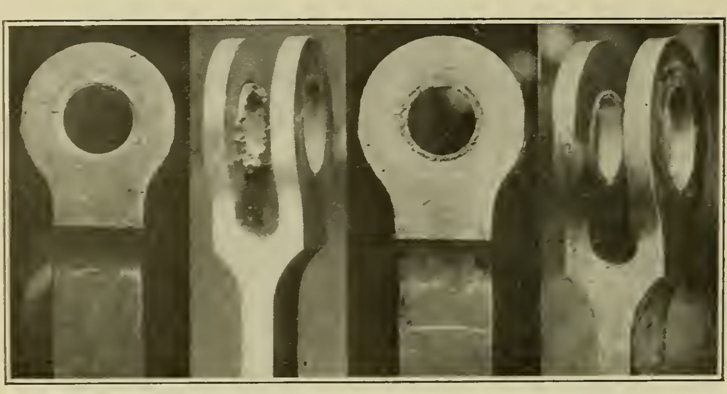

Figure 10.

Figure 10 shows parallel rods whose knuckle joint bushing holes have become worn beyond the limit. They are also shown welded and re-bored to the correct size. The work cost but 75 cents, against $7.50 by the old method, and was accomplished by the metal electrode.

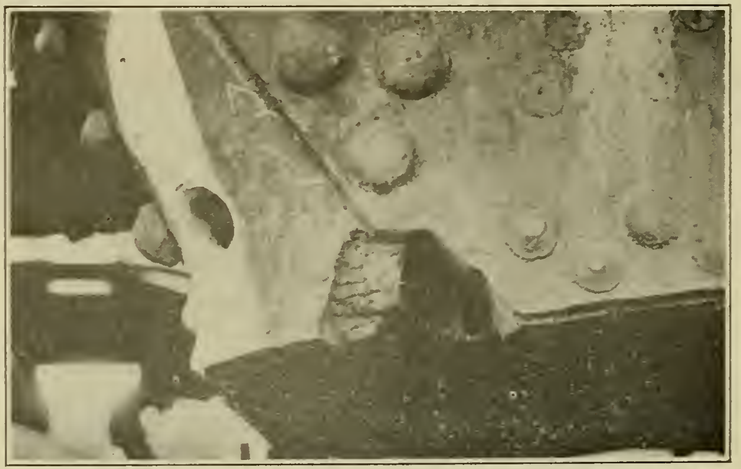

Figure 11.

Figure 11 shows a mud ring of a very large engine which was broken through at the left front corner and repaired by the metal electrode. The broken ring was drilled, chipped, and then welded by filling in 74 cubic inches of solid metal.

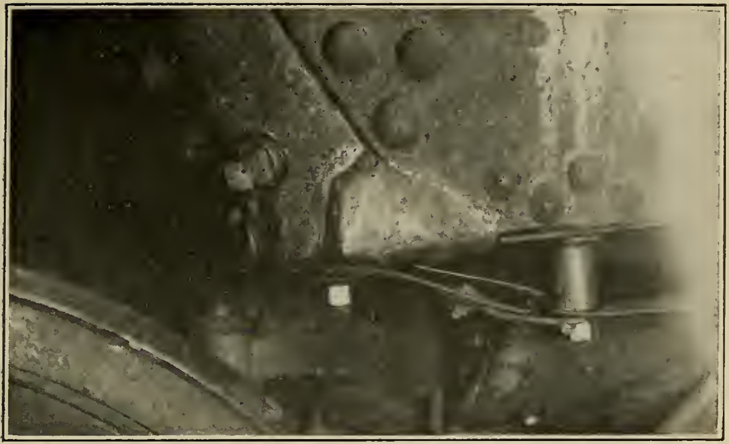

Figure 12.

Figure 12 shows the work completed. If it had been necessary to remove the mud ring and repair it in the blacksmith shop, the expense would have amounted to about $118. This work was done at a complete cost of $32.07.

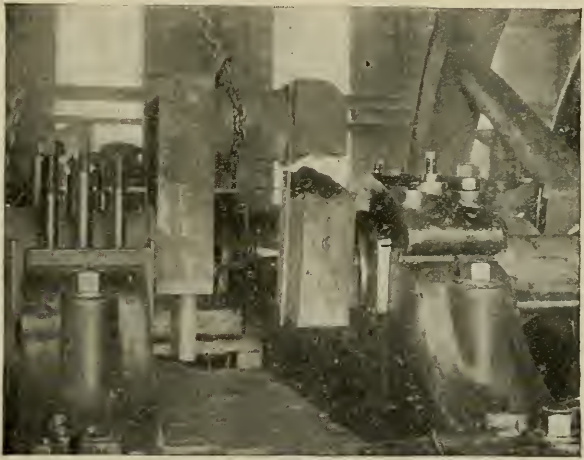

Figure 13.

Figure 13 is an illustration of a very heavy piece of work which was welded with the carbon electrode. It is a large high grade steel crank shaft with a complete break through one leg and measured 8x11″. Had the engine, which was of 1000 H. P. been dismantled the cost of repair would have amounted to $4,500. By the electric method it was welded within twenty hours and cost less than $40.00. This repaired crank shaft has now been running over three years.

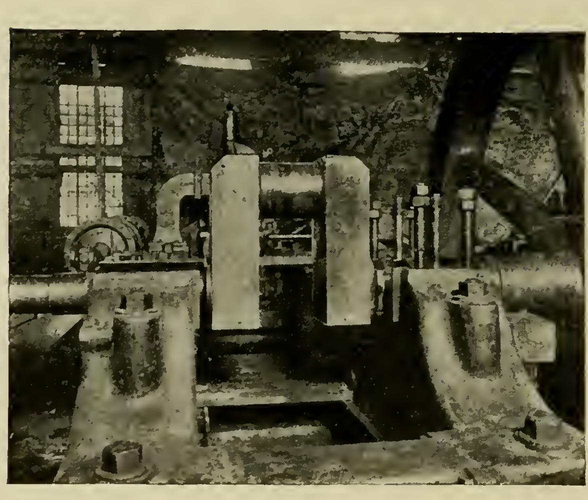

Figure 14.

Figure 14 shows the weld completed, and engine ready for service.

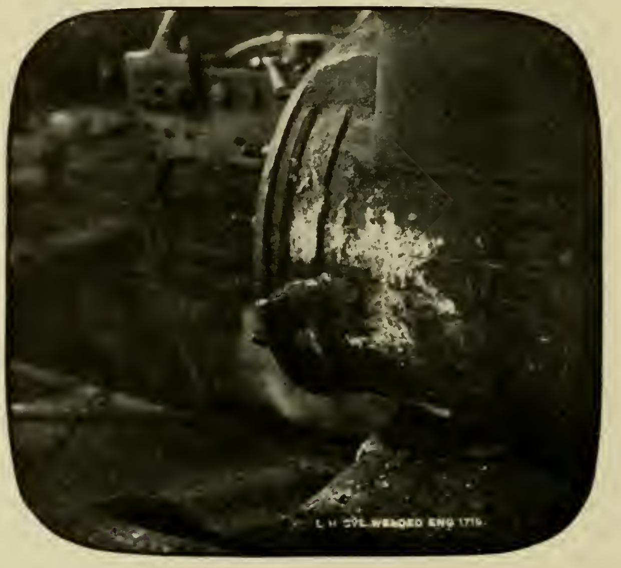

Figure 15.

Figure 15 shows the left cylinder of a heavy consolidated locomotive with two cracks, one being 9″ and the other 8″ long, running from the front edge inward. The cylinder is made of cast iron.

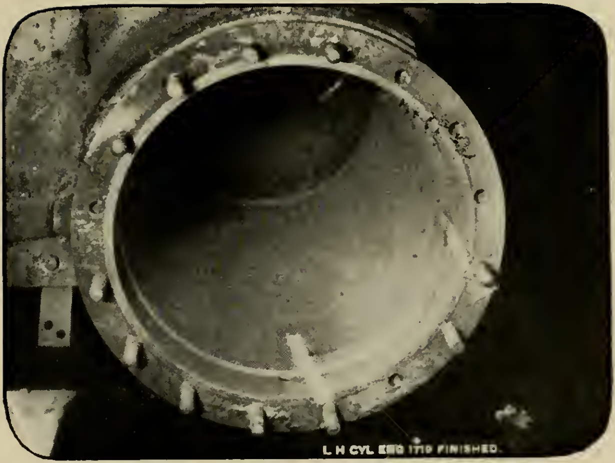

Figure 16.

Figure 16 shows the cracks welded by the metal electrode and the cylinder bored ready for service. Had the old method been used these cracks would have been dove-tailed and copper patches inserted, but this would not have strengthened the cylinder, as was the case with electric welding. This work complete cost $2.90, against $3.50 by the old method.

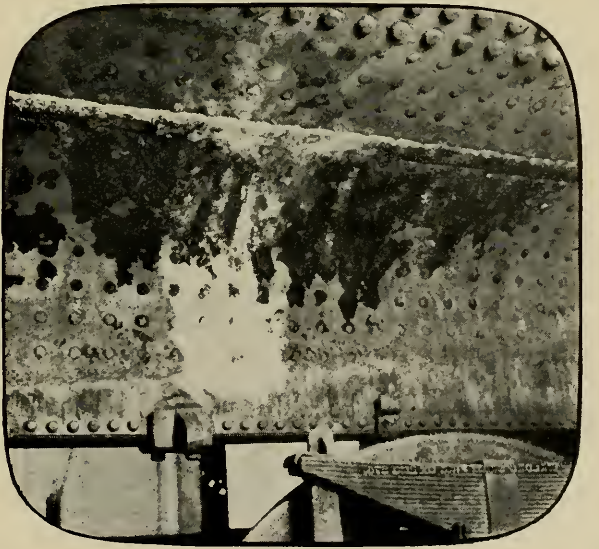

Figure 17.

Figure 17 shows the electric welding of a long seam in a fire box. The longitudinal seams between the side sheets and crown sheet were so wasted away by calking that the engine was sent to the shop for a new fire box. The seams were welded their entire length, approximately 6 ft. by 10", by the metal electrode method, averaging 3" in width and 3/8" in thickness. Had the engine received a new fire box it would have been necessary to strip it and remove the boiler to the boiler shop. The total cost of building in a new fire box, including stripping, etc., would have cost over $777. These seams were welded in complete, including everything, for $56.40.

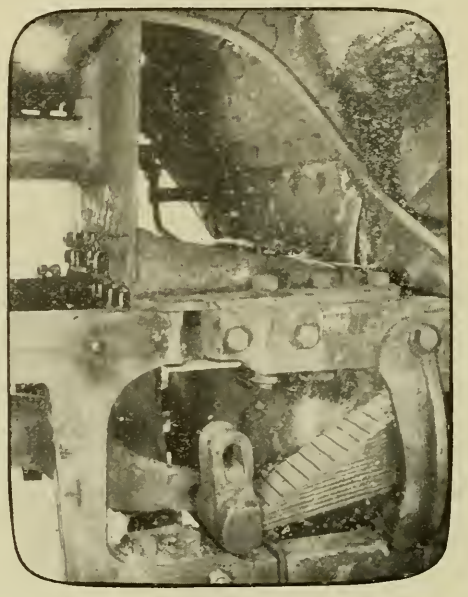

Figure 18.

Figure 18 shows a locomotive frame that has been cut out with the carbon electrode and faced off with pneumatic tools, prepared for welding. A plate is also shown underneath the V section which is used in keeping the molten metal from dropping away when the welding is started. This frame was welded by using the carbon electrode throughout.

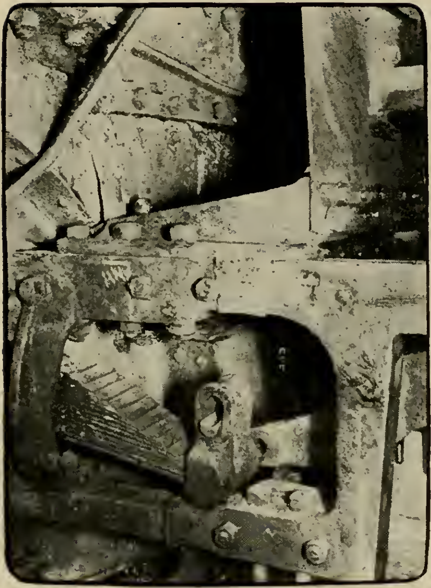

Figure 19.

Figure 19 shows the frame welded. This weld required about three hours 'time with a cost of about $3.75, including everything.

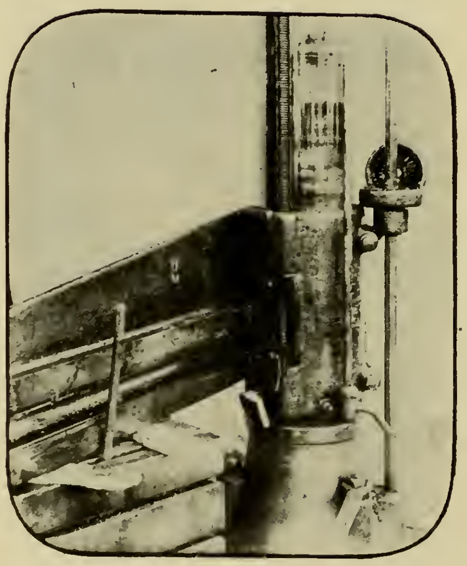

Figure 20.

Figure 20 shows a radial drill which has met with a serious accident. The cast iron casting supporting the arm was broken in three parts. This casting was removed and welded with the carbon electrode.

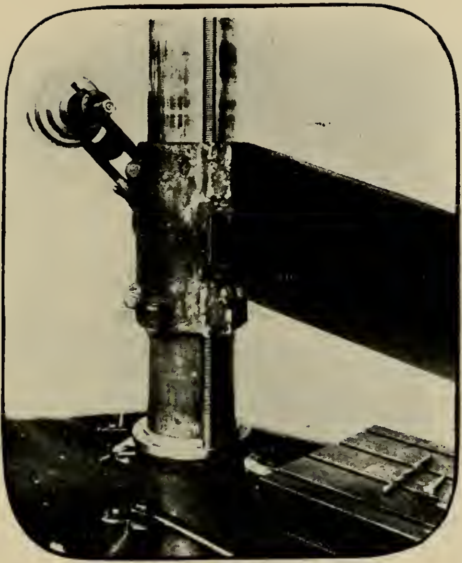

Figure 21.

Figure 21 shows the casting welded and the drill ready for service. A high grade piece of cast iron was used in making this weld.

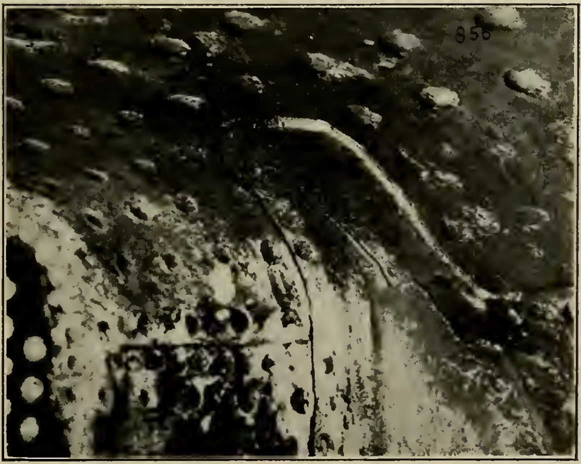

Figure 22.

Figure 22 shows a very large crack welded with the metal electrode. This crack extended from the side sheet up into the crown sheet. It took no more time to weld this crack than it would have had the entire crack been on the side sheet.

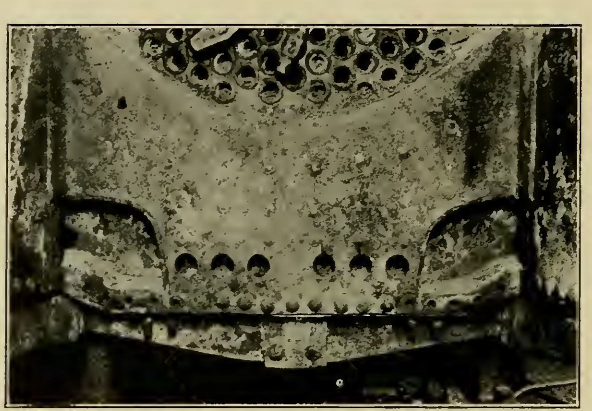

Figure 23.

Figure 23 shows the two lower corners of a flue sheet cut away at the mud ring. There was a very bad break at both corners and the sections were cut out with the carbon electrode to prepare them for a patch.

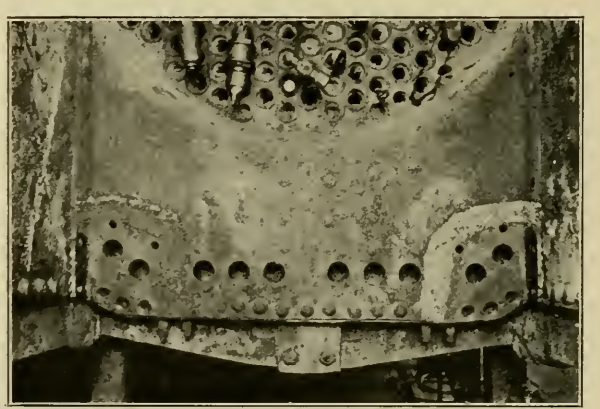

Figure 24.

Figure 24 shows the patches welded in position. Two men were used on this work, each man working on a patch. This tends to demonstrate the speed with which fire box troubles can be remedied when a system is used that will allow for the operation of more than one man at the same time. The operators are subjected to practically no heat and there are no dangerous gases by which they may be overocme.

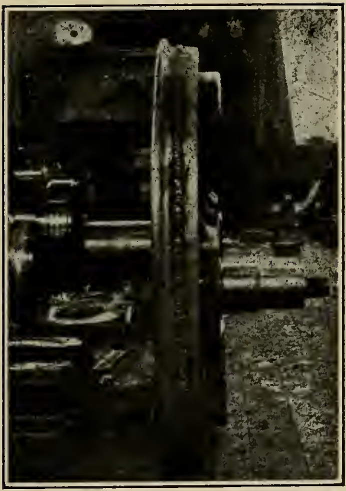

Figure 25.

Figure 25 shows an engine driving tire which had been gouged to a depth of 3/16" by a lathe tool.

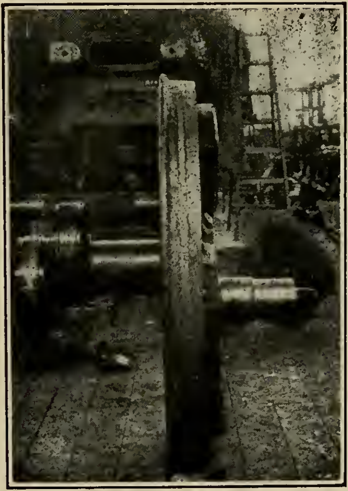

Figure 26.

Figure 26 shows recess filled with material deposited by the metal electrode. It was figured out that if it had been necessary to turn down the driving tire with its mate, the cost in material and labor would have been $8.00. The weld, including labor, current, etc., was accomplished for 72c.

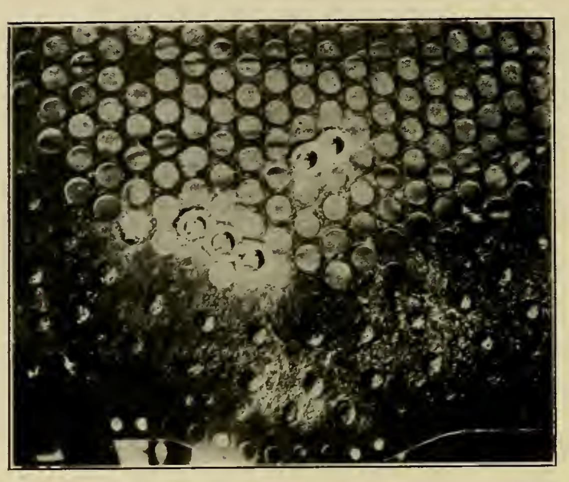

Figure 27.

Figure 27 shows flue sheet with a few tubes welded in position by the metal electrode.

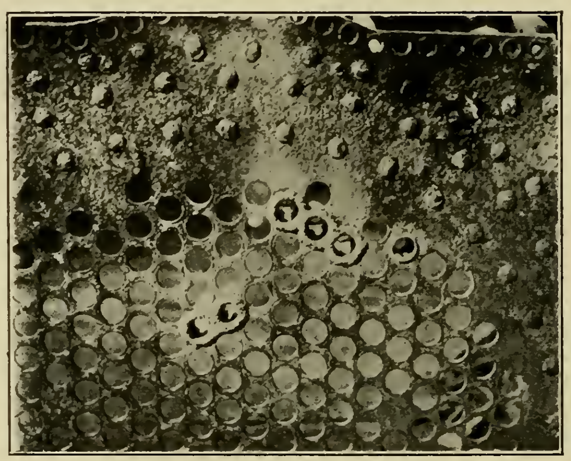

Figure 28.

Figure 28 shows the tubes trimmed and ready for service.

Flue welding is the latest step in the operation of the metal electrode. It is being done on several railroads with the greatest of success and from carefully kept data it is found that very little trouble is experienced with flues welded by the metal electrode. One railroad at the present time is welding complete sets of flues in thirty-six different locomotives.

CONCLUSION.

The welding equipment is simple, consisting of a motor generator set of special construction with certain automatic switchboard regulations. The art of welding is very easy, because it is necessary only to maintain a constant arc, and the operator in a few trials becomes thoroughly familiar with it. The amount of current is quickly determined when the arc is first made and the board is then set for the proper ampereage. As soon as an operator, however, becomes accustomed to the method he usually gets the proper regulation by merely inspecting the work. The automatic arrangement of the switchboard is such that the motor generator set is always protected from short circuit. It is also positive in action on the make and break of the arc.

There is nothing constructed of iron and steel, whether castings, forgings, or rolled, regardless of size, that cannot be welded by the metal electrode. Tensile tests of welded bar iron and steel show from 90% to 100% efficiency. These tests have been made at laboratories independent of the welders. Carefully kept data of different railroads show the metal electrode work to cost from 50% to 10% that of older methods.

The process eliminates all danger of fire or explosion and the voltage used is so low that the operator is subjected to absolutely no danger. The absence of danger, coupled with the ease and economy of operation, and the elimination of severe contraction or cooling strains tends to make electric welding the ideal process for the modern railroad shops of today.

PRESIDENT: Mr. Hibbard is prepared to answer any questions that may be asked on the subject, and I hope there will be plenty of them. I will ask Mr. D. J. Redding to open the discussion.

MR. D. J. REDDING: I am very much interested in the welding proposition. We have been looking into it to some extent recently with a view to using something of that kind, and I have gone to several places where electric welding and oxygen welding is in use and have studied their methods somewhat, and I can say this for this particular system that has been illustrated here, that some test pieces which we obtained welded by this method showed a higher tensile strength when tested than anything else we have been able to get hold of.

I believe from my observation that a great deal of the success of any of the methods depends on the skill of the operator. Mr. Hibbard feels that the operator does not need very much training with their method, which would be in its favor, because some of the welds I have seen made by some operators would hardly hold together long enough to carry out of the shop, while others, as I have said, tested very high. There is no question that there is a big field opening up for all these methods of welding. The best one will probably get the cream of the field.

MR. R. F. EISSLER: I would like to ask Mr. Hibbard whether it is necessary to have any pre-heating; how he gets away from the strain. For instance, in the driving-wheel picture he showed, a wheel welded in the spoke, often on cooling there is liable to be trouble and the strain will crack it apart again. I do not know whether that is the fault of the inexperienced operator or whether pre-heating is necessary. In the gas apparatus very often it is necessary to pre-heat so that you get a uniform cooling. I would like to know whether he does any pre-heating.

MR. HIBBARD: We have found that it is unnecessary to pre-heat. In some cases the spoke is cut away with the pneumatic tools and at other times with the carbon electrode. When the carbon electrode is used in cutting away it heats it up to a sufficient degree, and we have never found cooling strains great enough to affect them. The speaker has seen probably hundreds of cases welded by the carbon method and also by the metal electrode. With the metal electrode there is no possibility of strains. And I have yet to see one that was unsuccessful with the carbon.

MR. REDDING: I would like to say that in welding broken spokes in a driving wheel, it is necessary to exercise some care as to the manner in which you prepare for welds. I saw one wheel welded where there were four or five spokes broken, and the people doing the work had neglected to take off the tire. Pressure from the tire forced the spokes together when fusion took place so that when the work was completed, the wheel was considerably under size at the points where these spokes were welded.

Another one was welded with the tire removed, a number of the spokes being broken, and when the work was completed that wheel was under size.

It would seem to be necessary in work of that kind to remove the tire, and then firmly clamp the broken sections into place before welding. This, of course, only applies where the spokes are broken in the section of wheel leading from one parting key to another, in which case that section of the wheel would be entirely separated from the remainder, but I feel that in any event the tire should be removed before any spokes are welded.

MR. A. STUCKI: The speaker stated that the cost of electric welding was brought down to 40 or even 10 per cent. of that of the older methods. Did he under this heading include the oxy-acetylene welding? If not, has he any figures showing the relative cost between electric and oxy-acetylene welding?

MR. HIBBARD: We base that on blacksmith methods. I am not well enough acquainted with the cost of oxy-acetylene. But in the great many cases I do know of, it was cheaper than gas to a very marked degree. In most of the work our figures have been computed as against the blacksmith method.

With regard to the operator, of course, the more the operator uses the electrode the more skillful he becomes. Very often, as Mr. Redding said, pieces look as though they might not hold together; but that is a case where a new man is being broken in or is negligent in his work. Continuous work by the operator makes him very efficient.

MR. B. KOPFERSCHMIDT: Do you have to heat it before you use the carbon electrode?

MR. HIBBARD: It depends upon the size and nature of the work. Sometimes it is well to pre-heat. Other times it is unnecessary.

MR. KOPFERSCHMIDT: When you cut it out with the electrode, how do you get the metal in there?

MR. HIBBARD: When the tire is removed the crack is cut out and the spoke blocked during the time that the metal is being fused in. Any other irregularity at the rim is filled in after the crack or break has been welded. The carbon method is similar in operation to the gas method. The electric arc takes the place of the gas torch.

MR. J. H. TRAVIS: I would like to ask Mr. Hibbard if he makes use of alterating current as well as direct current?

MR. HIBBARD: No, it is all direct current, low voltage.

MR. TRAVIS: Do you have anything to use to facilitate the removal of rivets from tenders and steel cars?

MR. HIBBARD: I see no reason why the process should not be employed, but I have never seen it used for that purpose.

MR. I. J. DAVIES: Speaking about reclaiming castings with the arc welding system, do you make any distinction in your metal electrode on account of the kind of casting you are welding? For instance, gray iron or cast steel; what kind of electrode would you use for each?

MR. HIBBARD: On cast steel the steel electrode is used. In filling in cast iron you use a good grade of cast iron.

MR. DAVIES: In other words, you use the same metal for filling that you are reclaiming?

MR. HIBBARD: Yes, sir, with this exception, that there seems to be a tendency in the carbon electrode to lower the carbon at the welding point, and it is the practice of using a metal that is a little higher in that content, and sometimes a little bit of manganese is added. This tends to give better results.

MR. EISSLER: I would like to know whether you ever use any flux to dissolve the oxide?

MR. HIBBARD: Yes, we use a flux on the metal electrode. The flux, which is of a powdered form, is made slightly plastic. The electrodes are then rolled in the flux and set aside to dry, and the flux gets in its work as the electrode gradually dissipates away.

MR. EISSLER: Also in cast iron where you have the tendency of the iron to flow away, do you use the carbon electrode or the metal electrode, where the amount of iron is so great that it will run away from you?

MR. HIBBARD: If the metal electrode is used, the metal cannot run away, because the small increments of metal become attached firmly to the work as they depart from the metal electrode. If the carbon electrode is used, as is the case on frames, cast iron or steel castings where there is a possibility of the molten metal flowing away, it is the practice to form a dam around the work of fire clay or some other similar material in order to prevent this action.

The operator must use his judgment as to the location of the crack or cavity he wishes to weld. If it is underneath it is wholly essential that he use the metal electrode.

MR. EISSLER: In your opinion does hammering after the weld increase the efficiency?

MR. HIBBARD: It seems to increase the efficiency.

PRESIDENT: May we hear from Mr. C. L. McIlvaine, of the Pennsylvania R. R.?

MR. C. L. McILVAINE: I came tonight just to listen and I do not know much about the subject. I am afraid Mr. Hibbard must have given me away, because he was in my office this morning. We are very much interested in this subject in Altoona, although we have not had any experience on our own account. On one of our divisions we were having considerable trouble with tube leakage in our Pacific type locomotives, which have tubes a little over 20 feet long, and thought we would try welding in a set on one of them, having an electric welding concern do the work. This engine had just had a new set of tubes put in and had made a few trips over the road when it was taken in hand and the tubes were welded to the back tube sheet by welding down the bead to the sheet. The engine was then put in service and it has been running since early in March and has made about 40,000 miles, during which time there has not been a leaking tube, nor has there been any work done on any of the tubes, with the exception of tightening three in the front tube sheet.

Another engine was chosen for comparison which had tubes put in about the same time, and it has had the customary amount of leakage and had the tubes reset practically every thirty days since.

We are now having a few more engines welded and are looking over the field of electric welding outfits, trying to make up our minds which is the best.

I have gotten a great deal of interesting information from the description of the process which Mr. Hibbard has given us this evening.

PRESIDENT: Mr. Allison, of the Pittsburgh Steel Foundry Co.

MR. JOHN ALLISON: I believe I have nothing special to say on the subject. I suppose it is well known that electric welding is used very generally in connection with steel castings. I noticed a view of a welded cylinder tonight. I would like to ask if that was a steel or cast iron cylinder?

MR. HIBBARD: That was a cast iron cylinder.

PRESIDENT: Mr. Lindstrom, can we hear from you?

MR. C. A. LINDSTROM: I don't think I have anything in particular to say. One point I did not quite understand from the pictures. How far does the weld extend into heavy metal? For instance, you weld a 4 by 4 section. Does it go clear down to the center of the section, or do you fill up on the outside with sufficient metal to make up for what you do not get in the center to have the same section in the frame? From samples shown on the screen I can see that is about the idea, that you have enough meterial on the outside to make up for what you do not weld in the center.

MR. HIBBARD: The material is cut away through the frame. In some cases where it is on a bad break a V is brought clear through the frame, but in case it is irregular the V is cut from the two opposite sides and meet in the center line of the frame.

MR. LINDSTROM: Then you begin to weld from the center out?

MR. .HIBBARD: Yes, where the V meets in the center you run from the center out. But if you run the V clear through to the other side you begin at the bottom and build up.

MR. LINDSTROM: What is the object of building up so much metal on the outside?

MR. HIBBARD: That is simply reinforcing it a little. It does no harm and it strengthens it.

MR. LINDSTROM: If you make it so much stronger at one point are you not liable to concentrate your stresses at another point?

MR. HIBBARD: We do not reinforce more than about ⅛″.

MR. LINDSTROM: Then the views were very much magnified.

MR. HIBBARD: Those pictures were taken before the weld was dressed down. After they are dressed down they are about as smooth as the rest of the frame; but it was found best to leave them a little bit reinforced and also free from dressing so that the slides would show it very much clearer. Otherwise you can hardly distinguish the weld.

PRESIDENT: Mr. Oswald, of the Pittsburgh Street Railways Co., may be able to give us some information.

MR. J. N. OSWALD: I can recall back to 1903 when I saw the first welding and it was then used chiefly on redeeming bad castings in a big steel foundry. If my memory serves me right, we then used only 25 volts. But it was new and in its infancy, and I believe they are using it to a great extent now.

MR. McILVAINE: Mr. Hibbard made a statement in his paper that types of electric welding other than the arc welding are not much used by the railroads, and he mentioned spot welding. This method of welding is being used at our Altoona shops with great success in the building of steel passenger cars, its principal field being in the welding of light sheets and mouldings, in place of using rivets. In this work it gives a very good job at a less cost, and it seems to me that it is a very valuable type of electric welding to the railroads.

Mr. HIBBARD: Yes, that type is used quite extensively upon very light work. What I had reference to when I made that statement was work in a locomotive shop. For thin sheets the resistance method is being used very extensively, particularly in the car department.

PRESIDENT: Mr. S. W. Dudley, of the Westinghouse Air Brake Co., do you use this process at the Westinghouse works?

MR. DUDLEY: Mr. President, this is a great surprise, because I came here simply as an interested spectator. I have nothing to offer on the subject in any way. Many valuable suggestions have been given us by the speaker. I know, of course, that the Westinghouse Electric and Manufacturing Company use electric welding processes of a great many kinds and I presume that any of you who do not have access to other places where electric welding is done could get some very interesting information and see some of the work being done at first hand there. I do not know that the Westinghouse Air Brake Co. have any occasion to use welding processes to any extent except in their reservoir department, where I think the acetylene process is used. So far as I know we have not done anything on any large scale in the electric welding processes.

MR. STUCKI: I might say that spot welding is also extensively used in bridge work.

PRESIDENT: Mr. C. H. Florandin, of the C. & C. Electric and Manufacturing Co.

MR. C. H. FLORANDIN: Mr. Hibbard has gone through the subject of electric welding in such a thorough manner that there is very little that can be said. The company that I represent makes a multiple unit outfit by which we are able to use a number of operators from the same set, some of them working with the metallic electrode and others with the carbon electrode. We have been doing that for quite some time. The Central Railroad of New Jersey, for instance, have a set where they run four or six operators at the same time. We also use a system of individual panels, which enable us to locate the panels at any point in the shop which may be convenient to the operator. For instance, a locomotive may be near the door and it may not be convenient to run a long line from the main switch board over to the door. In that event the individual panel is very useful.

As far as the carbon electrode is concerned, it is, of course, much more rapid than the metallic electrode—I should say about three times as rapid. As to the cost of the work, it is, for ordinary work, about $1.20 an hour. The metallic electrode, on the other hand, would be about 85 cents. But when we consider that we get out much more work with the carbon electrode, it is far cheaper. On the other hand, there are classes of work that cannot be welded with the carbon electrode that can be welded with the metallic electrode, such as welding overhead, for instance.

Our records agree very closely with those that have been given by the various speakers, so there is not very much to say on that score. As far as the metallic electrode is concerned, the sizes run from ⅛" to about 3/16" in diameter, and the amperage will vary from about 50 amperes to 150 amperes. In connection with our outfit, however, we use a push button control. We have a combination holder that enables the operator by merely pushing a button to switch from the carbon electrode to the metallic electrode. We find at times that if the section of the metal is very heavy pre-heating by the carbon electrode is essential. If you attempt to build up with small increments of metal on a large section which is cold the weld, of course, can not be homogenous, and therefore it is necessary to pre-heat slightly with the carbon electrode.

The question of eye protection is one that comes up very frequently. We find that it is necessary to have a face shield and that protects the eyes sufficiently. We use ruby and blue glass for the purpose. That seems to be about all that is necessary. The operator wears usually leather gloves or gloves of some sort of heavy material.

I can not think that there is anything else that I can say on the subject. The various speakers have brought out about everything there is in the line of welding. We have done a great deal of cast iron work in repairing broken tools, etc. The holder which we use is of such design that it is of minimum weight. By means of an ingenious device the electrode may be removed and a new one replaced very quickly. This is also very important.

It is frequently found necessary to anneal both carbon and metallic welds, and we do that whenever the question of strains is important. So far as poor welds are concerned, it is quite true that they frequently occur when the operator has not sufficient experience or instruction. But we make it a point whenever we sell an equipment to have the operator thoroughly posted by the instructor whom we send out from the shop.

PRESIDENT: Mr. Seixas, may we hear from you?

MR. H. G. SEIXAS: I thank you for the opportunity to say a few words, but there is very little that has not already been covered that can be suggested. My experience has been in connection with welding of the pure irons so well known today that I would like to ask Mr. Hibbard if he has had any experience with his machine in connection with the welding of any of the new pure irons so well known to most of us. There has been some difficulty experienced along these lines and it would be interesting to have the results of any actual tests that have come under Mr. Hibbard's observation. If any of the Westinghouse Electric men are present they may be able to shed some light on the subject.

MR. HIBBARD: I can not say that I do know much about the operation with pure iron. The class of work that we have been dealing almost wholly with, or at least that I have been in contact with, has been with such work as we find in locomotive and car service, and I do not recall any case where we have had anything to do with pure iron.

PRESIDENT: Are there any Westinghouse Electric men here that could give us any light on this subject? If not, Mr. Hibbard, have you anything further to say in closing?

MR. HIBBARD: I think the subject has been pretty well covered. There is nothing more that I have to say. The principal feature developed in the discussion seems to be that a great deal of the operation is right up to the operator. The more skilled a man becomes the more successful his welds are. We have not experienced any trouble in breaking men in. It is a very simple process, and the safety feature of it speaks very highly for the process. The voltages are low, so low that the operators are in practically no danger whatever. I do not think of anything more that I can say on the subject.

PRESIDENT: Mr. Howe, may we have the report of the Nominating Committee?

MR. D. M. HOWE: Your Committee selected to nominate officers for this Club for the ensuing year, beg leave to make the following report:

President, Mr. A. G. Mitchell.

First Vice-President, Mr. F. M. McNulty.

Second Vice-President, Mr. E. J. Searles.

Treasurer, Mr. F. H. Stark.

Secretary, Mr. J. B. Anderson.

Executive Committee, L. H. Turner, D. J. Redding and F. R. McFeatters.

Finance Committee, D. C. Noble, Stephen C. Mason, E. K. Conneely.

Membership Committee, D. M. Howe, A. W. Crouch, Charles A. Lindstrom, H. H. Maxfield and A. Stucki.

PRESIDENT: Regular ballots will be sent to the members by the Secretary and due time given in which to vote.

MR. REDDING: I move that we extend to Mr. Hibbard a vote of thanks for his very able talk on electric welding.

The motion was duly seconded and carried by unanimous vote.

PRESIDENT: Mr. Hibbard, permit me to extend to you the thanks of the Club.

ON MOTION, Adjourned.

J. B. Anderson
Secretary.

SOCIETY OF RAILWAY CLUB SECRETARIES MEETING AND DINNER, JUNE 15, 1912.

The Society of Railway Club Secretaries met in annual session Saturday, June 15, 1912, at the Hotel Marlborough-Blenheim, Atlantic City, N. J.

In the absence of Mr. George H. Frazier, Chairman, and Mr. C. W. Alleman, Vice-Chairman, Mr. J. B. Anderson, Secretary of The Railway Club of Pittsburgh, was called to the chair and presided throughout the meeting.

From Mr. Frazier had been received a letter and telegram expressing his regret in being prevented by business engagements from attending the meeting and later the dinner, and stating that he would be present in spirit and extending cordial greetings.

The various clubs, with the exception of the Richmond Railroad Club, Southern and Southwestern Club and Northern Club were represented by their Secretaries, Presidents and First Vice Presidents.

Regrets were received from absentees that their duties prevented their reaching Atlantic City and sending greetings and best wishes for the continued success of the organization.

The Secretary-Treasurer presented the following report, which was received and ordered spread upon the Minutes:

To the Officers and Members of the Society of Railway Club Secretaries:

Gentlemen:—In presenting his Annual Report your Secretary-Treasurer has to say that the past year has been so free from special incident that there is little of unusual interest to communicate. We have pursued the even tenor of our way fulfilling the purpose for which we were organized and practically accomplishing all the objects designed to prove of mutual benefit and helpfulness to each other in the performance of our duties in connection with our respective individual clubs.

Unfortunately the matter of the resignation of the Western Railway Club which was tabled two years ago with the understanding that it would be taken in hand by a Special Committee and an effort made to induce reconsideration and withdrawal, has been allowed by default to remain in status quo. Whether the object in view can be accomplished is still a matter of uncertainty and certainly it should now be determined whether the resignation shall be accepted, or the idea of two years ago pursued to a definite finish.

Circumstances made it inadvisable and in a measure impossible to pursue further the proposed organization of the American Society of Railway Club Secretaries. There is reason to believe, however, that the proposition can be carried out to better advantage during the ensuing year. Secretaries of several associations have shown their sympathy and readiness to co-operate, and expressed the opinion that though a beginning will have to be made in a small way and possibly with a limited membership, the inception will be upon a substantial basis and steady growth in numbers become assured if those who can give it the right impetus take hold with the right spirit, and there is that unity of action in missionary work which makes for the success of any undertaking of that character. There is now in contemplation a movement of which the organization of this association is to be one of the features and which it is expected will culminate in the achievement of the purpose in view when the idea was first suggested. While we have had no accession to our membership for several years there appears to be an opportunity of effecting an increase during the ensuing year, from the fact that several new railway clubs have within a comparatively recent period been formed and probably only the right invitation presented at the psychological time and some personal effort to induce membership in our Society is needeed to have them unite with us.

For the consideration of the new administration it is suggested that study be made as to the causes or reasons why some of our members fail to attend our meetings, and why more of the associate members are absent at a time when we earnestly desire them to be with us. Presidents and first vice-presidents of clubs who constitute the latter class either do not care for our affiliation or can see no occasion for their participation in our work as a society. This is a question upon which every secretary should ponder and determine the answer. In the beginning of the society they were always with us at our annual meetings, but the number who now do so is discouragingly small. It is, of course, a stubborn fact that at the conventions with which we meet simultaneously for one day, sundry duties and obligations devolve upon them which cannot be ignored and absorb much of their time. Therefore, the inquiry arises as to whether we have made a mistake in our arrangements and would it be desirable to select some other time and place? Would the result be any better? Would improved conditions follow? Would we accomplish more in the line of benefits that we seek to attain? Perhaps these suggestions will be deemed too much of a case of "much ado about nothing," but be that as it may they have come to the mind of your Secretary-Treasurer in a way that could not be ignored while he has been the only "man on the job" here for several days. If their presentation has no other effect than to "start something," it will, at least, have saved his associates from altogether forgetting that this is neither a one or two-man organization and it is very essential that all concerned shall try to do something for the preservation of the Society and the good record established in the past.

One feature that marks this record and stands out in bold relief as of permanent good is the publication annually of the Index of Subjects. Whatever may be the experience of other members of the Society the writer knows it is highly valued for reference purposes by many members of the clubs which he has the appreciated honor of serving. In addition, as the compiler and publisher of the book, he knows it is found useful in other directions by men not eligible to affiliation with railroad clubs, and every new issue is followed by frequent application for copies of Club Proceedings containing certain papers. Were it desirable, many instances could be cited of certain specially valuable papers being sought as much for the enlightenment of department subordinates as the immediate superiors of such subordinates.

The financial statement for the year shows total receipts, including last year's balance, of $220.33 and disbursements of $125.50, leaving a balance of $94.83 to the credit of the new year.

Respectively submitted,

HARRY D. VOUGHT,
Secretary-Treasurer.

The matter of the resignation of the Western Railway Club was taken from the table and the Chairman requested to pursue the subject of withdrawal with the President of the Club.

The Secretary-Treasurer was continued as a Committee of One (1) with the understanding that an effort would be made to complete the organization of the American Association of Railway Club Secretaries during the ensuing year.

The Secretary-Treasurer reported that Mr. W. F. Jones, First Vice-President of the Central Railway Club, Past President of the General Storekeepers' Association, and General Storekeeper of the N. Y. C. & H. R. R. R., had been invited to preside at the annual dinner to be given in the evening at the Hotel Strand, and that he had accepted the invitation.

An appropriation of $25.00 to the Secretary-Treasurer for stenographic and clerical services during the year was authorized.

On motion of Mr. Powell, Mr. Frazier was re-elected Chairman, Mr. J. B. Anderson, Vice-Chairman, and Mr. Harry D. Vought, Secretary-Treasurer.

The annual assessment for the current expenses of the Society was continued at $15.00, as hertofore.

There being no other business the Society adjourned.

In the evening the members, with a number of their friends, participated in the annual dinner at the Hotel Strand. Mr. W. F. Jones presided.

Covers were laid for 30 and the occasion in all respects was very enjoyable.

Respectfully submitted,

HARRY D. VOUGHT,

Secretary-Treasurer.

In Memorium

H. W. RINEHART

DIED JUNE 21, 1912

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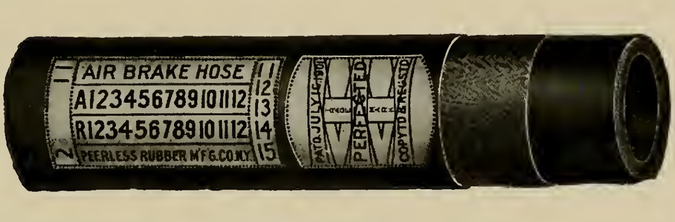

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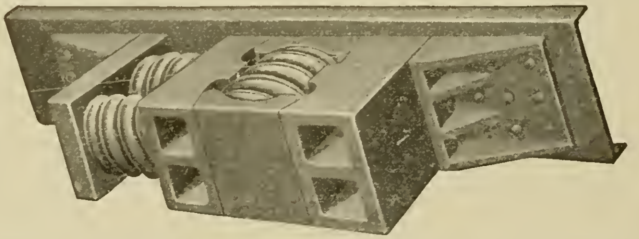

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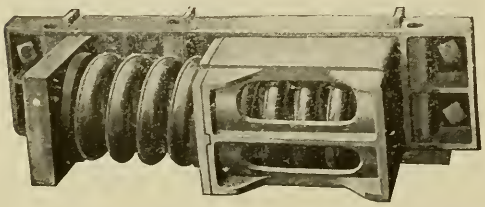

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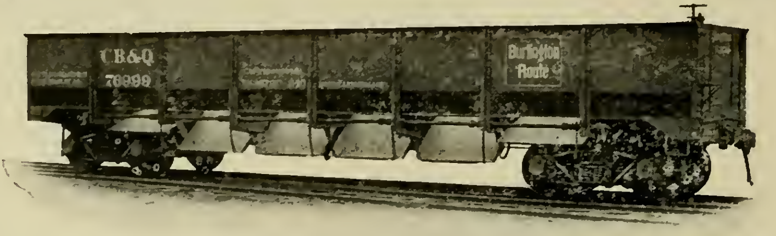

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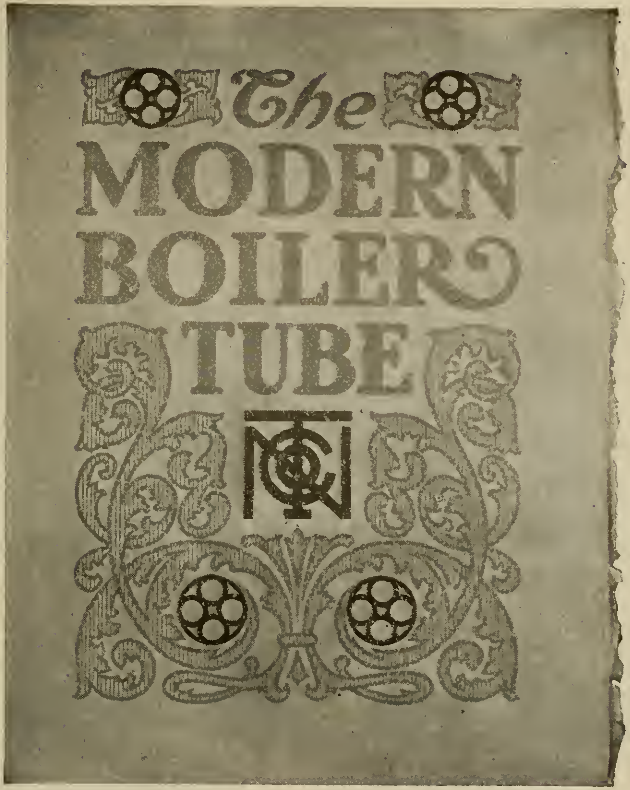

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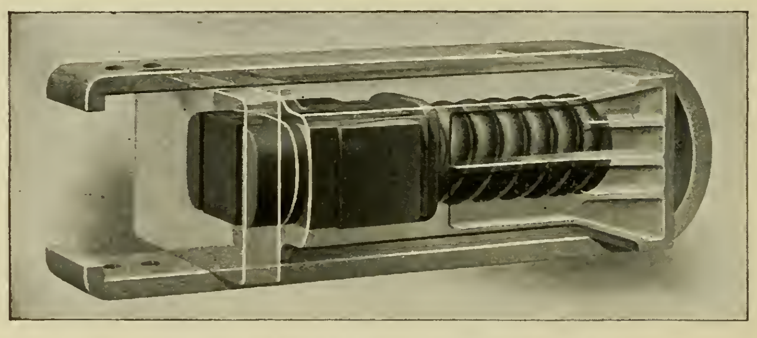

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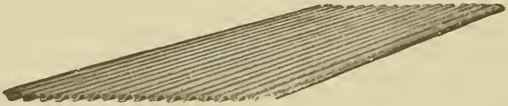

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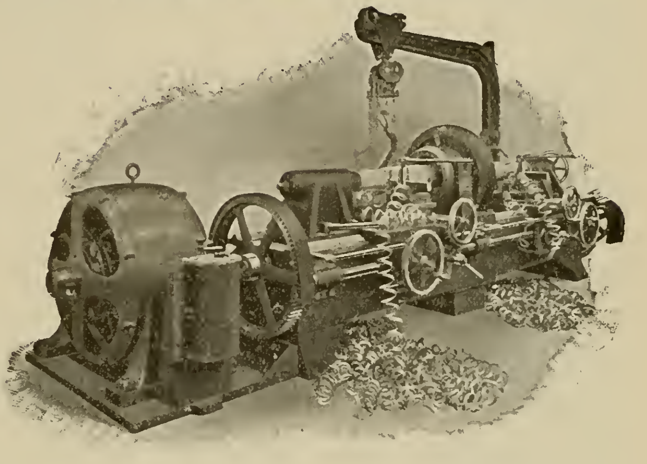

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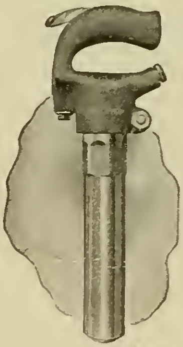

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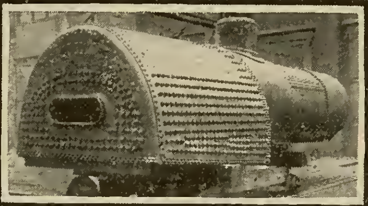

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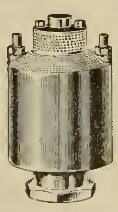

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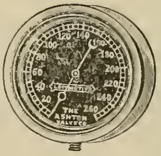

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Pittsburgh, Pa., October 25, 1912.
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Meetings held fourth Friday each month, except June, July and August.

PROCEEDINGS OF MEETING, OCTOBER 25th, 1912.

The regular monthly meeting was called to order at the Monongahela House, Pittsburgh, Penna., at 8:00 o'clock P. M., with President F. R. McFeatters in the chair.

The following gentlemen registered:

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PRESIDENT: The minutes of the last meeting being in the hands of the printer, we will dispense with reading them.

The Secretary read the following applications for membership:

Antes, Edwin L., Foreman, Pressed Steel Car Co., No. 33 Highland Ave., McKees Rocks, Pa. Proposed by Harry Howe.

Ashcroft, Chas. D., Manager, Hartford Steam Boiler Inspection & Insurance Co., 1801-02 Arrot Bldg., Pittsburgh, Pa. Proposed by A. W. Crouch.

Andresen; A. M., Salesman, Chicago Pneumatic Tool Co., No. 10 Wood St., Pittsburgh, Pa. Proposed by M. O'Connor.

Baylor, H. N., Foreman, Penna. R. R. Co., 7401 Susquehanna St., Pittsburgh, Pa. Proposed by W. H. Sullivan.

Bond, W. W., Assistant Road Foreman Engines, Penna. R. R. Co., 5447 Kincaid St., Pittsburgh, Pa. Proposed by W. L. Hudson.

Burns, J. D., Salesman, Crucible Steel Co., 241 Trowbridge St., Hazelwood, Pittsburgh, Pa. Proposed by F. M. McNulty.

Goetz, Henry L., Asst. Supt. Power Dept., Jones & Laughlin Steel Co., 5807 Elmer St., Pittsburgh, Pa. Proposed by A. A. Shook.

Hettler, R. C., Asst. Genl. Foreman, Penna. Lines West, Allegheny, Pa. Proposed by Geo. E. Gies.

Howe, John, Foreman Boiler Shop, B. & O. R. R., Glenwood, Pa. Proposed by M. O'Connor.

Hueber, Chas. M., Clerk, Mon. Con. R. R., 260 Atwood St., Oakland, Pittsburgh, Pa. Proposed by F. M. McNulty.

Lakin, J. Harry, Sales Agent, Power Plant Specialties, Fulton Bldg., Pittsburgh, Pa. Proposed by F. M. McNulty.

Lyle, D. O., Asst. on Engineer Corps, Penna. Lines, 1013 Penn Ave., Pittsburgh, Pa. Proposed by R. D. McKeen.

McAllister, D. R., Asst. Traffic Manager, Thompson Starrett Co., Second National Bank Bldg., Pittsburgh, Pa. Proposed by R. H. Mackenzie.

MacQuown, C., Genl. Manager, Gem Manf'g Co., Thirty-third and Spruce Sts., Pittsburgh, Pa. Proposed by V. J. Burry.

Runser, K. W., Supt., Gem Manf'g Co., Thirty-third and Spruce Sts., Pittsburgh, Pa. Proposed by V. J. Burry.

Smoot, W. D., Foreman Power Plants, Penna. Lines West, 501 California Ave., Avalon. Proposed by Geo. E. Gies.

Swope, B. M., Motive Power Inspector, Penna. R. R., Oakmont, Pa. Proposed by E. L. Frazier, Jr.

Shremp, Jos. A., Foreman, Freight Car Builders, Penna. Lines West, Conway, Pa. Proposed by Geo. B. Forsythe.

Sigafoos, Gus., General Yard Master, B. & O. R. R., 4501 Second Ave., Pittsburgh, Pa. Proposed by A. F. Coulter.

Thompson, C. H., Yard Master, Union R. R., 420 Todd St., Wilkinsburg, Pa. Proposed by A. F. Coulter.

PRESIDENT: As soon as these applications have been favorably acted upon by the Executive Committee, the gentlemen will be admitted to membership.

SECRETARY: We regret to announce the death of E. Gaither Huyett, connected with the Standard Steel Car Company. Mr. Huyett was elected to membership in this Club November 27, 1903.

PRESIDENT: We will now have the annual report of the Secretary and Treasurer.

SECRETARY'S REPORT.

To the Officers and Members of The Railway Club of Pittsburgh:

Gentlemen:—I beg to submit below statement of the events closing the eleventh anniversary of the Club.

Death has removed from our midst during the year the following members: F. M. Townsend, Wallace M. Johnson, W. W. Young, J. H. McAdoo, James Kennedy, H. W. Rinehart and E. G. Huyett.

The following is a summary of the membership, financial condition, etc., for the year up to and including this meeting:

MEMBERSHIP.

Reported last year	869	
Received into membership during the year	191	
Reinstated	1	
		1,061
Suspended, non-payment of dues	48	
Resigned	46	

Loss of address	11	
Removed by death	7	
		112
Present membership		949

FINANCIAL.

Receipts:—

In hands of Treasurer last year	$2,351 68	
From advertising	2,166 03	
From dues	2,475 00	
From sale of Proceedings and other sources	207 20	
From Minstrel Entertainment	3,041 75	
		$10,241 66

Disbursements:

Printing Proceedings, advance sheets, notices, etc.	$3,636 46	
Hotel, lunch, etc.	549 00	
Postage for Journals, etc.	567 60	
Secretary's expenses at Atlantic City M. C. B. Convention	50 00	
Cigars for meetings	112 85	
Stereopticon light	50 00	
Stationery and supplies	95 55	
Messenger service	34 00	
Reporting proceedings	150 00	
Entertainment	209 48	
Minstrel entertainment	1,769 32	
Miscellaneous	80 92	
Floral emblems	9 00	
Secretary's salary, year 1911-1912	500 00	
		$ 7,814 18
Balance in hands of Treasurer		$ 2,427 48

J. B. ANDERSON,
Secretary.

Approved:
L. H. TURNER,
F. H. STARK,
D. J. REDDING,
} *Executive Committee.*

TREASURER'S REPORT.

Receipts:		
Balance on hand from last year	$2,351 68	
Received from Secretary during the year	7,889 98	
		$10,241 66
Disbursements:		
Paid out on Secretary's checks		$ 7,814 18
Balance on hand		$ 2,427 48

Respectfully submitted,

J. D. McILWAIN,
Treasurer.

Approved:
L. H. TURNER,
F. H. STARK,
D. J. REDDING,
Executive Committee.

PRESIDENT: Is the Executive Committee ready to report on the election of officers?

MR. D. J. REDDING: Mr. President and Members: I take pleasure in announcing the election of the following officers for the ensuing year:

President—A. G. Mitchell.

First Vice-President—F. M. McNulty.

Second Vice-President—E. J. Searles.

Treasurer—F. H. Stark.

Secretary—J. B. Anderson.

Executive Committee—L. H. Turner, D. J. Redding, F. R. McFeatters.

Finance Committee—D. C. Noble, Stephen C. Mason, E. K. Connelly.

Membership Committee—D. M. Howe, A. W. Crouch, Chas. A. Lindstrom, H. H. Maxfield, A. Stucki.

The total vote cast was 339. The lowest number of votes received by any successful candidate was 333. So that you may see these gentlemen were elected by a very large majority. (Applause.)

D. J. REDDING,
Member Executive Committee.

PRESIDENT: We will call on the newly-elected President, Mr. A. G. Mitchell.

MR. A. G. MITCHELL: Mr. President and Gentlemen: I know you do not wish a speech tonight, because this is the evening for other entertainment. I wish, however, to thank you for conferring the honor upon me and ask the help of the other elected officers and of you all to make this Club a success in coming years. I thank you for your support.

PRESIDENT: Mr. McNulty, First Vice-President.

MR. F. M. McNULTY: Mr. President and Gentlemen: It was a surprise to me that I had no opposition for this office to which you have elected me. However, I want to thank each and every member of the Club for his support, and will say that I will always have the interest of the Club in mind and will do all I can for its advancement. I consider it an honor to be a member of The Railway Club of Pittsburgh, and certainly appreciate the honor you have conferred in electing me First Vice-President. I thank you all.

PRESIDENT: Our newly-elected Second Vice-President, Mr. Searles, is sick and unable to be here, but we would like to have some promises from our new Treasurer, Mr. Stark.

MR. F. H. STARK: Mr. President and Gentlemen: Inasmuch as there is in store for us a treat, I am sure you are not anxious to hear from such ordinary fellows as myself, and I will beg to be excused. I will promise to take care of all the money that you will entrust to me, and if you will keep pretty close tab on me, you will get it all back in some form or another.

MR. D. J. REDDING: Gentlemen, I am sorry to appear before you again and take up so much of your time, but I have been delegated to the very pleasant task of saying a few words to our retiring President, Mr. McFeatters.

I do not think it will be necessary for me to take up very much of your time in telling you about Mr. McFeatters, as you all know him as well as I do for an open-hearted, big-souled fellow, and I think you will all agree that he has added to the prestige of The Railway Club of Pittsburgh during the two years in which he has served as President. In doing this, however, his bed has not always been one of roses; there have been times in which he has had to work so late in order to perform the duties imposed upon him by the Club, that he has been kept away from his family until rather late hours, and it is said that he is the man of whom the story was originally told, who went home very late one night, took off his shoes, and slipped quietly upstairs. His wife, however, was awake and waiting for him and said: "Why Frank, it is very late. Where have you been?" He answered, "I've been to a meeting of The Railway Club, my dear, and it's only about one o'clock." Just then the clock struck four. "Why," his wife said, "it's four o'clock," and he replied, "Oh, the clock stuttered; you mustn't mind it."

In order that he may have no such trouble as that in the future, we are going to present to him a clock which has the feature of being capable of being set wherever you want it. Then when he comes home late at night, he can set it back so that it will strike nine if he wants it to.

Mr. McFeatters, we present you with this clock, and we hope you will take good care of it and keep it wound.

In order that Mrs. McFeatters might not feel slighted, we have secured a pair of very elegant vases, and we present them to Mrs. McFeatters, because we know she will find better use for them than you could.

We hope in the years to come, Mr. McFeatters, when you look at these slight tokens of our regard, you will always have a kindly feeling for The Railway Club of Pittsburgh.

MR. STARK: Mr. President, it would be unfair for my friend Redding to have an opportunity to talk the second time without passing the privilege around. This is the occasion of the year when we usher into office the newly-elected officers, indicating our confidence and assuring them of our co-operation, and at the same time bid adieu to such officers as are willing to vacate. Some "you have with you always." (Laughter.)

My friend Redding has very appropriately expressed his appreciation of our whole-souled friend, the President, who is without doubt a man among men, and I trust he is so with the ladies.

A MEMBER: I can vouch for that, because we were born in the same town. (Laughter.)

MR. STARK: We of course would not forget our able Secretary, who has piloted the ship during the past year so successfully. The financial report is a credit to him.

The other officers, too, have contributed their part, and not only the officers but many of the members; and if any of the members care to become officers of the Club and take their chance of being perpetuated in office, if they would just get busy like Brother Crouch and the others, we guarantee they would find a place on the roster of officers. This life is like a drama, change of scenery and of actors. Some come on the scene and last but a day, while others are with us for years.

One of our retiring officers tonight is a man that we all know and love for his charity and his good will toward all men. He has faithfully filled a position of trust ever since this club was organized, and I am sure we owe to him a great deal. He is a modest man, seldom says very much about himself, but always is on the alert to build up The Railway Club of Pittsburgh. It is my pleasant duty to direct my remarks to our retiring Treasurer, Mr. McIlwain, and we trust that the sunset of his life may be strewn with roses and that he and his good wife may enjoy for years the fruits of their many good deeds.

Mr. McIlwain, in behalf of the members of The Railway Club of Pittsburgh, I hand you this token of regard. We do not want you to consider it from its intrinsic value, but from the spirit in which it is prompted. And may you live many years and inspire the young and the old to emulate your many beautiful characteristics.

PRESIDENT: Members of The Railway Club of Pittsburgh, I want to thank you for the honor conferred on me as being your executive officer for the last two years. I thank you in behalf of Mrs. McFeatters and myself for your kind remembrance.

MR. J. D. McILWAIN: There are two or three around here who are urging me to talk, but I will not take up much of your time. During the several years I have had the honor of serving this Club as Treasurer my relations with the several officers and members have been always pleasant and agreeable, and I regret that my physical condition compels me to refuse to serve you longer. Mr. Stark's remarks have certainly caught me off my guard. However, I sincerely thank the members of the Club for their remembrance.

PRESIDENT: Gentlemen, after the program and the entertainment we will have lunch served in all the cafes on the first floor. We have also arranged for the one back next to the bar tonight. Any who are not familiar with that part of the building call on Mr. Howe, who will direct you there. (Laughter.)

MR. HOWE: I appreciate the honor.

PRESIDENT: We will now turn over the carrying out of the program to the Secretary, Mr. Anderson. He is responsible for this entertainment and not I. If it is good, give him the credit; if it is not, he gets the eggs.

SECRETARY: Now, gentlemen, if you will give us your kind indulgence for about five minutes until we get this stage cleared off, we will proceed with the program.

The following program was rendered:

PROGRAM.

1. America ....
Orchestra.

2. (a) My Rosary of Dreams ....Westman
(b) When Uncle Joe Plays a Rag.................Morse
(c) Play Me a Good Old-Fashioned Melody........Meyer
Quartet.

3. Singing Comedienne ....
Miss Pearl Buhl.

4. Tenor Solo, Mother Machree ....Moore
Dr. Harmount.

5. Comedy Singing and Specialties ....
Ring and Williams.

6. Bass Solo, Invictus .... Huhn
Mr. Lockie.

7. Vaudeville Cleverest Impersonator ....
? Guise ?

8. (a) Well, I Swan ....
(b) Enuff ....
(c) We All Fall .... Haviland Quartet.

9. Selection .... Orchestra

Music by Rocereto's Orchestra.

The Highland Quartet—Dr. W. C. Harmount, First Tenor; A. J. Phillips, Second Tenor; B. H. Mustin, Baritone; L. G. Lockie, Bass.

After the entertainment the following menu was served to the members of the Club and visitors:

MENU.

Puree of Tomatoes

Radishes Olives

Cutlet of Chicken Duchesse

June Peas

Assorted Sandwiches

Neapolitaine Ice Cream

Assorted Cake

Coffee

Pipes Tobacco Stogies

Fatima Cigarettes

"Guid Nicht"

In Memorium

E. GAITHER HUYETT

MEMBERS.

Ackenheil, J. D.,
Railway Paints,
Palmyra, N. Y.

Adams, Chas. B.,
Engineer of Construction,
Pressed S. C. Co.,
Euclid Apts.,
Bellevue, Pa.

Adams, Lewis,
Clerk, P. S. Car Co.,
4004 Northminister St.,
N. S., Pittsburgh, Pa.

Albree, Chester B.,
President and Chief Engineer,
Chester B. Albree Iron
Works Co.,
Metropolitain St.,
N. S., Pittsburgh, Pa.

Alexander, J. R.,
Gen'l R. F. of E.,
Pennsylvania R. R. Co.,
Altoona, Pa.

Alleman, C. W.,
Chief Clerk to S. M. P.,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Allen, Harry L.,
Manager,
American Steel Foundries,
Alliance, Ohio.

Allen, Jas. P.,
Secretary,
Union Steel Castings Co.,
61st and Butler Sts.,
Pittsburgh, Pa.

Allison, John,
Chief Engineer,
Pittsburgh Steel Fdy. Co.,
Glassport, Pa.

Altman, C. M.,
Asst. Foreman Car Insp.,
P. R. R. Co.,
R. F. D. No. 2,
Jeannette, Pa.

Amsbary, D. H.,
Manager, Dearborn Drug
& Chemical Works,
Farmers Bank Building,
Pittsburgh, Pa.

Anderson, D. W.,
Mgr., Ry. Steel Spring Co.,
20th and Liberty Sts.,
Pittsburgh, Pa.

Anderson, Hans S.,
Asst. Mechanical Engineer,
H. K. Porter Co.,
225 Millvale Ave.,
Pittsburgh, Pa.

Anderson, J. B.,
C. C. to S. M. P., P. R. R. Co.,
207 Union Station,
Pittsburgh, Pa.

Anderson, J. P.,
Chief Draftsman,
P. S. Car Co.,
North Rebecca (near
Black St.),
Pittsburgh, Pa.

Andresen, A. M.,
Salesman, Chicago
Pneumatic Tool Co.,
No. 10 Wood St.,
Pittsburgh, Pa.

Andrews, Fred. G.,
Manager, Pittsburgh
Pit Post Co.,
Room 907 Arrott Bldg.,
Pittsburgh, Pa.

Angell, C. P.,
Ass't. Train Master,
B. and O. R. R. Co.,
312 Winston St.,
Pittsburgh, Pa.

Antes, Edwin L.,
Foreman, Pressed Steel
Car Company,
No. 33 Highland Ave.,
McKees Rocks, Pa.

Anthony, H. F.,
Telegraph Operator,
P. R. R. Co.,
7219 Finance St.,
Homewood Station,
Pittsburgh, Pa.

Arensberg, F. L.,
Asst. Mgr., McCullough-Dalzell Crucible Co.,
36th St. and A. V. Ry.,
Pittsburgh, Pa.

Artzberger, L. C.,
Foreman,
H. K. Porter Co.,
5126 Dearborn St.,
Pittsburgh, Pa.

Ashcroft, Chas. D.,
Mgr., Hartford Steam Boiler Inspection & Insurance Co.,
1801 - 02 Arrot Bldg.,
Pittsburgh, Pa.

Ashley, F. B.,
Special Agent, Penna Lines, West of Pgh.,
Room 724 Union Station,
Pittsburgh, Pa.

Ashworth, Wm.,
Salesman, Johnston, Morehouse, Dickey Co.,
P. O. Box 308,
Pittsburgh, Pa.

Atterbury, W. W.,
Vice President,
Pennsylvania R. R. Co.,
Philadelphia, Pa.

Atwood, J. A.,
Chief Engineer,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Ayers, H. B.,
Gen. Mgr., H. K. Porter Co.,
49th St. and A. V. Ry.,
Pittsburgh, Pa.

Backoski, Jos. G.,
Stenographer,
American S. S. & Mfg. Co.,
56th & Butler Sts.,
Pittsburgh, Pa.

Bailey, H. H.,
Yard Master,
P. R. R. Monon. Div.,
Monongahela, Pa.

Bailey, J. H.,
Foreman,
56th St. Works,
The McConway & Torley Co.,
Pittsburgh, Pa.

Bailey, R. E. L.,
Sec'y., American Spiral Spring and Mfg. Co.,
56th St. and A. V. Ry.,
Pittsburgh, Pa.

Baird, F. C.,
G. F. A., B. & L. E. R. R.,
Room 618 Frick Building,
Pittsburgh, Pa.

Baker, B. R.,
Mgr., Gulf Refining Co.,
Gross St. and P. R. R.,
Pittsburgh, Pa.

Baker, C. L.,
Chief Clerk, Carnegie Steel Co. and Car Accountant,
Pgh. and Ohio Valley Ry., Vance Ave.,
Coraopolis, Pa.

Baker, Edwin H.,
Second Vice President,
Galena Signal Oil Co.,
26 Broadway,
New York, N. Y.

Baker, J. H.,
Clerk, M. P. Dept.,
P. R. R. Co.,
207 Union Station,
Pittsburgh, Pa.

Bakewell, Donald C.,
Rep. Duquesne Steel Fdy. Co.,
Arrott Bldg.,
Pittsburgh, Pa.

Baldwin, Stephen Y.,
Com. Frt. Agent,
D. & H. Co., Bessemer Bldg.,
Pittsburgh, Pa.

Baldwin, G. C.,
General Foreman,
Lumber Dept.,
Pressed Steel Car Co.,
McKees Rocks, Pa.

Ball, Geo. L.,
Treasurer,
Ball Chemical Co.,
153 East Ohio St.,
Millvale, Pa.

Bannister, E. J.,
Rep., Crucible Steel Co.
of America, 5621 Butler St.,
Pittsburgh, Pa.

Barker, A. E.,
Salesman,
Firth-Sterling Steel Co.,
Oliver Building,
Pittsburgh, Pa.

Barker, B. F.,
Weighmaster, B. R. & P. Ry.,
132 So. Brady St.,
DuBois, Pa.

Barnes, P. H.,
Gen'l. Car Foreman,
B. & O. R. R.,
Zanesville, Ohio.

Barney, Harry,
Secretary and Treasurer,
Laughlin-Barney Machinery
Co.,
Union Bank Bldg.,
Pittsburgh, Pa.

Barth, John W.,
Lemington Ave.,
12th Ward,
Pittsburgh, Pa.

Bartley, Milton,
President, American Nut &
Bolt Fastener Co.,
P. O. Box 996,
Pittsburgh, Pa.

Barwis, J. McC.,
Gen'l. Fore., P. C. Insp'rs.,
P. R. R. Co.,
Union Station,
Pittsburgh, Pa.

Basford, G. M.,
Ass't to President,
American Loco. Co.,
30 Church St.,
New York, N. Y.

Basler, F. M.,
Asst. Scale Inspector,
P. R. R. Co.,
809 Fifth Ave.,
Altoona, Pa.

Battinhouse, John,
Inspector, W. A. B. Co.,
670A Middle Ave.,
Wilmerding, Pa.

Bauer, A. C.,
Foreman Erecting Shop,
P. R. R. Co.,
228 N. Rebecca St.,
Pittsburgh, Pa.

Baylor, H. N.,
Foreman, Penna. R. R. Co.,
7401 Susquehanna St.,
Pittsburgh, Pa.

Bealor, B. G.,
Vice Pres. and General
Manager,
Althom Sand Co.,
421 Wood St.,
Pittsburgh, Pa.

Beatty, E. A.,
Foreman, American
Locomotive Co.,
1429 Woodland Ave.,
N. S., Pittsburgh, Pa.

Beatty, E. G.,
Rep., Galena Signal Oil Co.,
Miller Park, Franklin, Pa.

Beatty, Harry M.,
Freight Conductor P. R. R.,
Elrama, Pa.

Beaumont, Clifton,
Sales Agent, Grip Nut Co.,
111 So. Gilmore St.,
Baltimore, Md.

Bell, Walter,
Inspector, P. R. R. Co.,
Penna. Lines Bldg.,
Pittsburgh, Pa.

Belleville, J. M.,
General Freight Agent,
Pittsburgh Plate Glass Co.,
Frick Building,
Pittsburgh, Pa.

Bellows, A. B.,
Vice Pres't., Pittsburgh
Testing Laboratory,
7th and Bedford Aves.,
Pittsburgh, Pa.

Belsterling, C. S.,
Traffic Manager,
American Bridge Co.,
Frick Building,
Pittsburgh, Pa.

Beltz, John D.,
Asst. R. F. of Eng's.,
B. & O. R. R. Co.,
107 Grant Ave.,
New Castle, Pa.

Bender, F. H.,
American Steel Foundries,
1624 Commercial National
Bank Bldg.,
Chicago, Ill.

Bengnot, J. J.,
General Foreman,
Pennsylvania Co.,
Alliance, Ohio.

Benner, Jacob W.,
C. E., Steam Power,
Carnegie Steel Co.,
Munhall, Pa.

Benner, Samuel A.,
Gen'l. Mgr. Sales,
Carnegie Steel Co.,
Carnegie Bldg.,
Pittsburgh, Pa.

Bennett, H. W.,
Clerk, Penna. R. R. Co.,
Union Station,
Pittsburgh, Pa

Bennett, R. G.,
c. o. Division Engineer,
Pittsburgh Division,
Pittsburgh, Pa.

Berg, Karl,
Draftsman, P. & L. E. R. R.,
224 Robinson St.,
Pittsburgh, Pa.

Berghane, A. L.,
Inspector, Westinghouse Air
Brake Co.,
352 Broadway,
Pitcairn, Pa.

Bernard, R. Y.,
Railway Supplies,
426 Land Title Bldg.,
Philadelphia, Pa.

Beswick, John,
Ass't. Road Foreman of
Engines, P. R. R. Co.,
2424 Beale Ave.,
Altoona, Pa.

Bigelow, Harry T.,
Rep., Hale & Kilburn
Mfg. Co.,
Fisher Building,
Chicago, Ill.

Bihler, L. C.,
Traffic Manager,
Carnegie Steel Co.,
Room 814 Carnegie Bldg.,
Pittsburgh, Pa.

Billingham, R. A.,
Supt. M. P.,
P. S. & N. R. R.,
St. Mary's, Pa.

Binns, J. Y.,
Special Agent,
Monongahela R. R. Co.,
Brownsville, Pa.

Black, Frank J.,
Assistant Superintendent
Carnegie Steel Co.,
Island Ave.,
McKees Rocks, Pa.

Blackall, Robt. H.,
Railway Supplies,
1305 Farmers Bank Bldg.,
Pittsburgh, Pa.

Blair, Harry A.,
Genl. Car Foreman,
B. & O. R. R.,
304 Renova St.,
Pittsburgh, Pa.

Blakely, T. M.,
R. F. of E., Penna. R. R.,
Penna. Lines Bldg.,
Pittsburgh, Pa.

Bleasdale, Jas.,
Supervisor Air Brakes,
B. & O. R. R.,
526 Wallace Ave.,
Wilkinsburg, Pa.

Blest, M. C.,
Mechanical Engineer,
Western Steel Car &
Foundry Co.,
Hegewisch, Ill.

Bogert, Wm. J.,
General Agent,
San Pedro, Los Angeles
and Salt Lake R. R.,
Oliver Building,
Pittsburgh, Pa

Bole, Robt. A.,
Vice Pres., Manning,
Maxwell & Moore,
Room 1004, Park Bldg.,
Pittsburgh, Pa.

Bond, W. W.,
Asst. Road Foreman of
Engs., Penna. R. R. Co.,
5447 Kincaid St.,
Pittsburgh, Pa.

Booth, Arthur,
Ass't. Gen'l. Pur. Agent,
Philadelphia Co.,
435 Sixth Ave.,
Pittsburgh, Pa.

Booth, Henry,
Road Foreman of Engines,
D. & H. Co.,
5 Canaan Street,
Carbondale, Pa.

Booth, J. K.,
Genl. Fore., B. & L. E. R. R.,
No. 8 Penn Ave.,
Greenville, Pa.

Booth, Jas.,
Rep., Midvale Steel Co.,
Oliver Building,
Pittsburgh, Pa.

Bottomly, E. S.,
Chief Joint Inspector,
B. & O. R. R. Co.,
Martinsburg, W. Va.

Boyer, Chas. E.,
Gen'l. Car Inspector,
P. R. R. Co.,
Room 204, Union Station,
Pittsburgh, Pa.

Boyer, John B.,
Loading Expert, Bridge Dept.,
The Penna. Steel Co.,
Steelton, Pa.

Boyle, H. Edgar,
Chief Clerk, Car Record Dept.,
Penna. Lines West of Pittsburgh, 1013 Penn Ave.,
Pittsburgh, Pa.

Brady, Daniel M.,
President, Brady Brass Co.,
95 Liberty Street,
New York, N. Y.

Brand, Thos.,
Train Master,
Montour R. R. Co.,
Coraopolis, Pa.

Brandt, E. K.,
Ass't. Train Master,
Penn'a R. R.,
Union Station,
Pittsburgh, Pa.

Branson, Craig R.,
M. P. Inspector,
Pennsylvania Co..
302 West Berry St.,
Fort Wayne, Ind.

Brantlinger, J. H.,
Engineman, P. R. R.,
226 Miller St.,
Mt. Oliver, Pittsburgh, Pa.

Bretz, F. K.,
General Manager, Morgantown and Kingwood R. R.
Morgantown, W. Va.

Brewster, Morris B.,
Rep., U. S. Metallic Packing
Co., 6040 Jefferson Ave.,
Chicago, Ill.

Briggs, Ira Otis,
Train Dispatcher,
Pittsburgh Division,
P. R. R. Co.,
Union Station,
Pittsburgh, Pa.

Briggs, Templeton,
Assistant Chief Inspector,
Carnegie Steel Co.,
Schoen Steel Works,
McKees Rocks, Pa.

Brooks, Walter A.,
Asst. Foreman Boiler Shop,
Penna. Co.,
3211 East St.,
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B. & O. R. R. Co.,
215 Crawford Ave.,
New Castle, Pa.

Wood, Ralph C.,
Draftsman,
City of Pittsburgh,
702 N. Homewood Ave.,
Pittsburgh, Pa.

Wood, W. H.,
Foreman Brass Fdy.,
Lines West,
32 Hubbard St.,
N. S., Pittsburgh, Pa.

Woodings, Emanuel,
General Manager,
Verona Tool Works,
Verona, Pa.

Woodside, S. P.,
General Freight Agent,
Wabash-Pittsburgh Ter. Ry.,
425 Wabash Bldg.,
Pittsburgh, Pa.

Woodworth, R. B.,
En'g., Carnegie Steel Co.,
427 Carnegie Bldg.,
Pittsburgh, Pa.

Worthington, W. R.,
Fire Marshal,
Penna. R. R. Co.,
Union Station,
Pittsburgh, Pa.

Wright, L. S.,
Asst. Supt.,
Pressed Steel Car Co.,
615 Cliff St.,
Bellevue, Pa.

Wright, R. V.,
Managing Editor,
Railway Age Gazette,
83 Fulton St.,
New York, N. Y.

Wyke, J. W.,
Traveling Engr., Union R. R.,
2223 Manor Ave.,
Swissvale, Pa.

Yohe, Curtis M.,
Purchasing Dept.,
P. & L. E. R. R. Co.,
Pittsburgh, Pa.

Yohe, Jay,
Ass't. Gen'l. Bookkeeper,
Penn. Lines West of Pgh.,
410 Union Station,
Pittsburgh, Pa.

Yohe, J. B.,
General Manager,
P. & L. E. R. R. Co.,
General Office,
Pittsburgh, Pa.

Zimmerman, Oliver L.,
Foreman Engine House,
Penna. R. R. Co.,
7345 Bennett St.,
Pittsburgh, Pa.

Zinsmaster, F.,
Fore. Engine House,
Penna. Company,
18 Ivanhoe Ave. ,
Emsworth, Pa.

The Railway Club of Pittsburgh Constitution

ARTICLE I.

The name of this organization shall be "The Railway Club of Pittsburgh."

ARTICLE II.

OBJECTS.

The objects of this Club shall be mutual intercourse for the acquirement of knowledge, by reports and discussion, for the improvement of railway operation, construction, maintenance and equipment, and to bring into closer relationship men employed in railway work and kindred interests.

ARTICLE III.

MEMBERSHIP.

Section 1. The membership of this Club shall consist of persons interested in any department of railway service or kindred interests, or persons recommended by the Executive Committee upon the payment of the annual dues for the current year.

Sec. 2. Persons may become honorary members of this Club by a unanimous vote of all members present at any of its regular meetings, and shall be entitled to all the privileges of membership and not be subject to the payment of dues or assessments.

ARTICLE IV.

OFFICERS.

The officers of this Club shall consist of a President, First Vice President, Second Vice President, Secretary, Treasurer, Finance Committee consisting of three members, Membership Committee consisting of five members, and three Elective Executive Members who shall serve a term of one year from the date of their election, unless a vacancy occurs, in which case a successor shall be elected to fill the unexpired term.

ARTICLE V.

DUTIES OF OFFICERS.

Sec. 1. The President shall preside at all regular or special meetings of the Club and perform all duties pertaining to a presiding officer; also serve as a member of the Executive Committee.

Sec. 2. The First Vice President, in the absence of the President, will perform all the duties of that officer; the Second Vice President, in the absence of the President and First Vice President, will perform the duties of the presiding officer. The First and Second Vice President shall also serve as members of the Executive Committee.

Sec. 3. The Secretary will attend all meetings of the Club or Executive Committee, keep full minutes of their proceedings, preserve the records and documents of the Club, accept and turn over all moneys received to the Treasurer at least once a month, draw cheques for all bills presented when approved by a majority of the Executive Committee present at any meetings of the Club, or Executive Committee meeting. He shall have charge of the publication of the Club Proceedings and perform other routine work pertaining to the business affairs of the Club under the direction of the Executive Committee.

Sec. 4. The Treasurer shall receipt for all moneys received from the Secretary, and deposit the same in the name of the Club within thirty days in a bank approved by the Executive Committee. All disbursements of the funds of the Club shall be by cheque signed by the Secretary and Treasurer.

Sec. 5. The Executive Committee will exercise a general supervision over the affairs of the Club and authorize all expenditures of its funds. The elective members of this Committee shall also perform the duties of an auditing committee to audit the accounts of the Club at the close of a term or at any time necessary to do so.

Sec. 6. The Finance Committee will have general supervision over the finances of the Club, and perform such duties as may be assigned them by the President or First and Second Vice Presidents.

Sec. 7. The Membership Committee will perform such duties as may be assigned them by the President or First and Second Vice Presidents, and such other duties as may be proper for such a committee.

ARTICLE VI.

ELECTION OF OFFICERS.

Sec. 1. The officers shall be elected at the regular annual meeting as follows, except as otherwise provided for:

Sec. 2. Written forms will be mailed to all the members of the Club, not less than twenty days previous to the annual meeting, by the three elective members of the Executive Committee. These forms shall provide a method, so that each member may express his choice for the several offices to be filled.

Sec. 3. The three elective members of the Executive Committee will present to the President the names of the members receiving the highest number of votes for each office, together with the number of votes received.

Sec. 4. The President will announce the result of the ballot and declare the election.

Sec. 5. Should two or more members receive the same number of votes, it shall be decided by a vote of the members present, by ballot.

ARTICLE VII.

AMENDMENTS.

Amendments may be made to this Constitution by written request of ten members, presented at a regular meeting and decided by a two-thirds vote of the members present at the next regular meeting.

BY-LAWS.

ARTICLE I.

MEETINGS.

Section 1. The regular meetings of the Club shall be held at Pittsburgh, Pa., on the fourth Friday of each month, except June, July and August, at 8:00 o'clock P. M.

Sec. 2. The annual meeting shall be held on the fourth Friday of October each year.

Sec. 3. The President may, at such times as he deems expedient, or upon request of a quorum, call special meetings.

Article II.

QUORUM.

At any regular or special meeting nine members shall constitute a quorum.

Article III.

DUES.

Sec. 1. The dues of members shall be $2.00 per annum, $1.00 of same to apply to subscription for Club Journal, payable in advance, on or before the fourth Friday of September each year.

Sec. 2. Each member will be assessed $1.00 extra annually to provide light refreshments for each meeting.

Sec. 3. At the annual meeting members whose dues are unpaid shall be dropped from the roll after due notice mailed them at least thirty days previous.

Sec. 4. Members suspended for non-payment of dues shall not be reinstated until all arrearages have been paid.

Article IV.

ORDER OF BUSINESS.

1—Roll call.
2—Reading of the minutes.
3—Announcements of new members.
4—Reports of Committees.
5—Communications, notices, etc.
6—Unfinished business.
7—New business.
8—Recess.
9—Discussion of subjects presented at previous meeting.
10—Appointment of committees.
11—Election of officers.
12—Announcements.
13—Financial reports or statements.
14—Adjournment.

Article V.

SUBJECTS—PUBLICATIONS,

Sec. 1. The Executive Committee will provide the papers or matter for discussion at each regular meeting.

Sec. 2. The proceedings or such portion as the Executive Committee may approve shall be published (standard size, 6x9 inches), and mailed to the members of the Club or other similar clubs with which exchange is made.

ARTICLE VI.

The stenographic report of the meetings will be confined to resolutions, motions and discussions of papers unless otherwise directed by the presiding officer.

ARTICLE VII.

AMENDMENTS.

These By-Laws may be amended by written request of ten members, presented at a regular meeting, and a two-thirds vote of the members present at the next meeting.

J. B. Anderson
Secretary.

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EDWARD KERR, President

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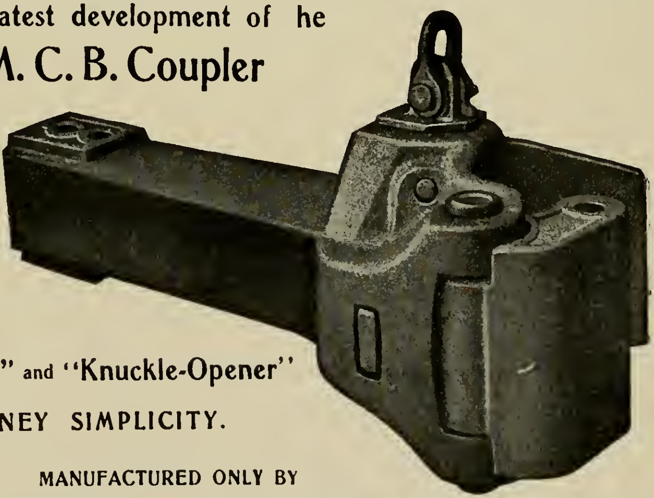

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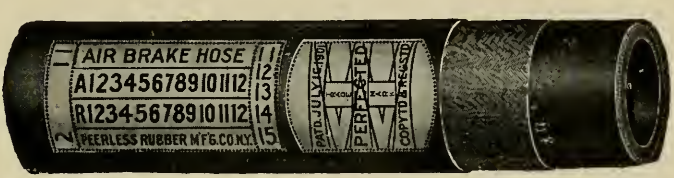

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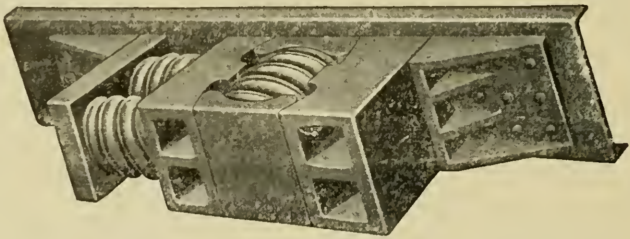

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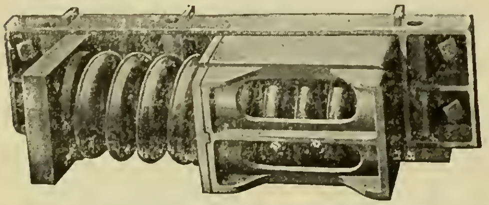

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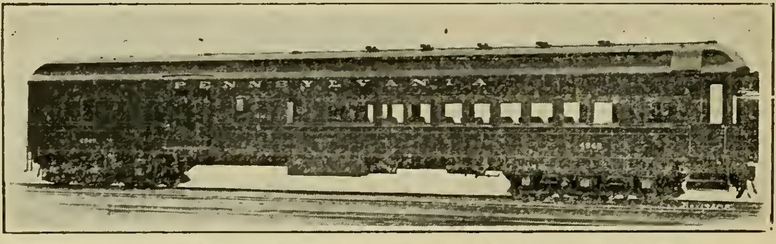

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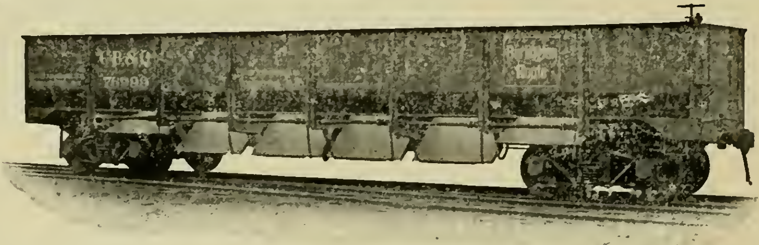

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